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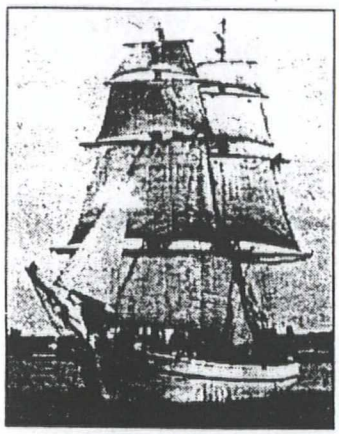
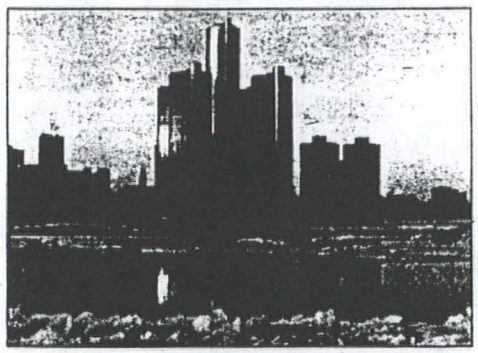
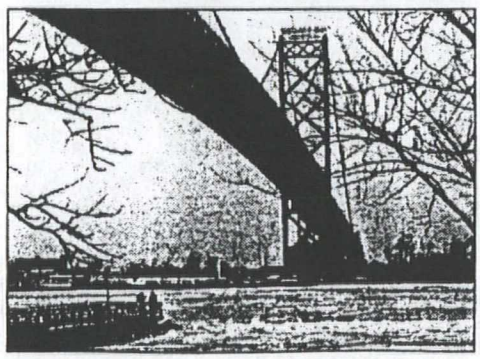
1996 Detroit River Remedial Action Plan Report



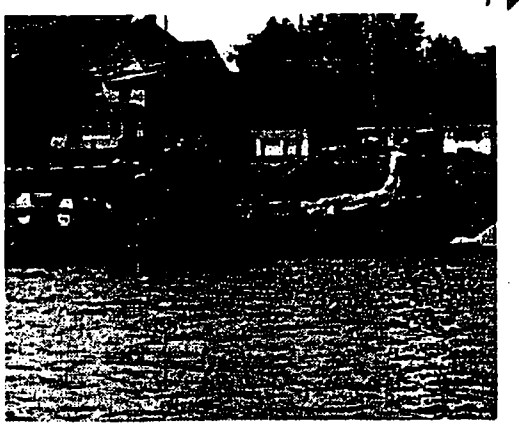




Contaminated Sediments TWG Report

Stage 2 of the RAP has documented the contamination of the Detroit River sediments by both historical, now inactive, industrial sources and by active sources. Next we must we must identify the specific causes of the various hotspots. Then, we can plan for the control of the active contributing sources and evaluate the best method for a cost effective remediation of the problem after determining that ongoing sources will not recreate the contamination.

Dr. Ralph Kummler,
Director, Hazardous Waste Management Programs, Wayne State University



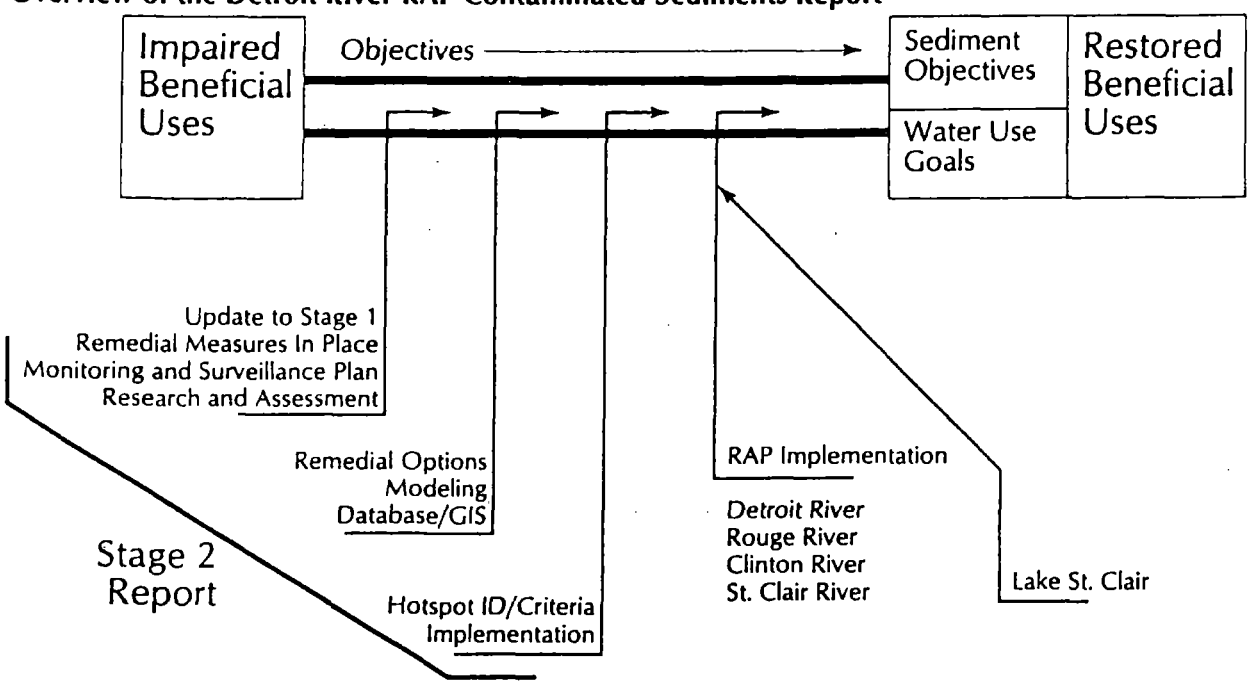
The issue of contaminated sediments is broad in scope and effects or is affected by many interrelated segments of our ecosystem. The concern centered on contaminated sediments in the Detroit River is well founded, as several impaired beneficial uses are attributed directly to the sediments and the pollutants that are harbored therein. A technical workgroup was created to address contaminated sediments issues within the Detroit River Area of Concern (AOC) and devise a strategy for their remediation.

In developing this report, the efforts of the Contaminated Sediments Technical Workgroup were guided by the milestones initially established for the Biennial Update process. Within the limited timeframe, the workgroup has reported progress towards achieving each milestone. Several tasks associated with particular milestones were intentionally omitted, as the workgroup had no authority to initiate what appropriately would have been an agency (MDEQ/MOEE) action. The workgroup has gone as far as recommending specific actions to be implemented by the agencies sponsoring the Remedial Action Plan.

The field of assessing and remediating contaminated sediments is evolving at rapid pace. Detroit River Sediments themselves pose specific challenges that hinder the technical workgroup from endorsing any individual remedial technologies. The workgroup has identified and reference the available technologies developed to date.

This report does not contain the entirety of remedial measures that are necessary for the complete restoration of the impaired beneficial uses identified with contaminated sediments in the Detroit River. The workgroup has identified various sediment parameter objectives, which when met, would restore the beneficial uses impaired by contaminated sediments and further the AOC towards delisting. To meet these objectives, implementation of the Detroit River Remedial Action Plan (RAP), along with the St. Clair River, Clinton, and Rouge River, are critical. The following pages are a first step in addressing prominent areas where the sediments are grossly polluted, and laying the foundation for further research, investigation and remediation.

Figure 5
Overview of the Detroit RIver RAP Contaminated Sediments Report



Goals/Objectives/Rationale

The Contaminated Sediments Technical Workgroup addressed two specific impaired beneficial uses – Degradation of Benthos and Restriction on Dredging. Objectives for impairments were developed to meet the Water Use Goals.

These goals and objectives, along with the corresponding rationale, are presented in this section.

Impairment: Degradation of Benthos

Goal

Establish and maintain benthic communities such that populations are diverse and appropriate for the physical characteristics of the area, and include pollution intolerant organisms.

Objective

Detroit River sediments should have balanced benthic macroinvertebrate communities as determined using appropriate scientific analysis (such as a multivariate analysis relating the benthic macroinvertebrate data to various physical and chemical data) and interpretation of species and abundance (MOEE, Environmental Assessment of Detroit River Sediments and Benthic Communities, 1991).

Rationale

The use of measurable numbers (i.e. Ephemeroptera less than 300 organisms per square meter) were discouraged by the Contaminated Sediment Technical Workgroup. The reason being that any given density of organisms is too highly dependent on the natural physical conditions present. More information can be gained from examining the entire range of organisms found at a site, applying the appropriate statistical analysis and relating the benthic macroinvertebrate data to the various physical and chemical (sediment) data.

Similarly, the Contaminated Sediment Workgroup also decided not to create a rigid list of appropriate pollution intolerant organisms which should be present at a given site. Once again, the community is too dependent on the natural physical conditions present. In addition, a unanimous agreement could not be reached between aquatic ecologists on what organisms best represented pollution intolerant organisms, or on what they were to be intolerant of. For example, a particular organism may be intolerant to elevated levels of metals while another may be intolerant only of organic enrichment.

Clearly, the task of interpreting the macroinvertebrate data is complex and not easily itemized into fixed rules based on numerical guidelines. The wording in the specific objective allows for the future evolution of statistical analyses as well as changes in our understanding of benthic macroinvertebrates.

Impairment: Restriction on Dredging

Goal

Concentrations of pollutants in sediments shall be below levels that restrict dredging activities.

Objective

Sediment contaminant levels of all parameters shall be below the most restrictive value (basinwide/jurisdictional) likely to be protective of sediment dwelling organisms, cognizant of historical background conditions (pre-ambrosia, pre-colonial).

Rationale

The rationale for establishing quantitative objectives is inherent to the impairments in that they must be the most restrictive values and biologically based because they must protect benthic organisms. Additionally, the objectives must be feasible and achievable relative to the natural condition of the Detroit river environment. The workgroup recognizes that the quantitative objectives potentially have a wide number of uses and applications in the Detroit River system.

The two primary sources for quantitative Detroit River sediment quality objectives were sediment guidelines from the MOEE and the USEPA. These guidelines were compared and the Detroit River objectives were based on the evaluation of several criteria:

1. the guidelines must be biologically based,
2. the guidelines were the most restrictive, and
3. the guidelines must be feasible and achievable.

These points were evaluated in a sequential manner and objectives established; however, in some cases, objectives are proposed which could not meet these requirements or could not be stringently evaluated. In these cases, long-held sediment quality guidelines have been adopted.

The workgroup recommends conditional acceptance of the sediment objectives described below. Conditional acceptance reflects the potential for re-examination and revision of the objectives as new information becomes available. When Detroit River sediments are found to contain one or more contaminants which exhibit concentrations equal to or greater than the objectives, sediments from that site exceed Detroit River Sediments Quality Objectives.

Recommendations

Recommendations for conditional acceptance of Detroit River Sediment Objectives are as follows:

A. Organic Contaminants: Polychlorinated Biphenyls, Organochlorine Pesticides, and Polycyclic Aromatic Hydrocarbons as stated by the MOEE Lowest Effect Level (LEL) or when specified, No Effect Level (NOEL).

B. Heavy Metals/Trace Elements: Chromium, Copper, Lead, and Mercury as stated by the MOEE, LEL.

C. Heavy Metals/Trace Elements: Barium, Cyanide, and Zinc as stated by the USEPA/FWPCA.

D. Heavy Metals/Trace Elements: Cobalt and Silver as stated by the MOEE (carried over from Open Water Disposal Guidelines).

E. Conventional Parameters: Total Organic Carbon, Total Kjeldahl Nitrogen and Total Phosphorus as stated by the MOEE.

F. Other Parameters: Ammonia, Chemical Oxygen Demand, Oil and Grease, and Volatile Solids as stated by the USEPA/FWPCA.

The Workgroup assessed the available sediment data pertaining to background conditions potentially applicable to the Detroit River. This is presented in Table 12. In the development of Detroit River Sediment Objectives, background conditions were taken into account to ensure that the objectives were attainable and not below background conditions. The pretense for establishing Detroit River Sediment Objectives is outlined in the section entitled "Summary of General Considerations for Establishing Quatitative Sediment Objectives for the Detroit River".

Table 12
Comparison of Background Conditions in the Huron-Erie Corridor Using Sediment Cores and Bluff Concentrations

	Lake Huron[1]	Lake Huron[2]	Lake Huron[3]	Range	Lake St. Clair[4] Sand	Slt/Cl	Detroit River[5]	Lake Erie[6]	Lake Erie[7]	Lake Erie[8]	Lake Erie[9]
As			4.2	8.4+					6.1		
Ba		145.7									
Cd	1	1.6	1.2	0.78-2.5	1.3	1.4	0.18	2.0	1.3	1	1.1
Cr		52.7	21	11-23	16	19.1	21.8				79
Co							4.6				
Cu	38	29.5	18	5.1-11.8	7	9.5	10.2	30	15	29	29
Fe		2.5%							22102		38200
Pb	39	27.1	18	0-13.1	8.4	10.6	11.9(BLD)	28	17	28	28
Mn		.036%						600	697		929
Hg	0.15		0.023	0.017+				0.1	0.02	0.078	0.08
Ni		34.9	15	8.5-21.1	13.6	17.6	14.6		18		68
Zn	94	62.9	29	29.4-55.4	36.5	45.2	40.6	70	46	98	98
TP			436					655	700		917

Concentrations are shown in ppm, unless otherwise indicated. Blank intervals = no data available.

Legend

1. Kemp and Thomas, 1976. Pre-colonial/Ambrosia horizon. Three cores from Lake Huron (whole lake).
2. Robbins, 1980. Stable zone (20-50cm). 27 cores from southern basins of Lake Huron.
3. Thomas and Haras, 1978. Average bluff concentrations for Lake Huron.
4. Rossmann, 1988. Stable zone. Twelve cores from Lake St. Clair (whole lake). +One core, unpublished data.
5. USEPA/LLRS, 1987. Lowermost interval. One core from Detroit River. Unpublished data.
6. Kemp and Thomas, 1976. Pre-colonial/Ambrosia horizon. Western basin of Lake Erie.
7. Thomas and Haras, 1978. Average bluff concentrations for Lake Erie.
8. Kemp and Thomas, 1976. Pre-colonial/Ambrosia horizon. Six cores from Lake Erie (whole lake).
9. Mudroch and Sandilands, 1979. Pre-colonial/Ambrosia horizon. Cores from Lake Erie (whole lake).

Table 13
Sediment Quality Objectives

Note: This table can be adjusted as new information becomes available. These objectives are biologically based, unless noted (*). Sediment objectives were not chosen for those parameters where existing background data was limited or exceeded the biologically based value. This was noted by ***.

All units = ppm dry weight, unless noted (%).

	Guidelines			Sediment Quality	Backgrounds		Detroit River Sediment Range	
	USEPA1	MOEE2	MOEE3	Objective	Lake St. Clair	Detroit River	RAP Stage 1	
ORGANIC								ORGANIC
Volatile Solids	5%		6%	5%				Volatile Solids
Solvent Extractables (Oil and Grease)	<1000	1500		1000			20-47226	Solvent Extractables (Oil and Grease)
PCB (total)	1	0.01		0.01			<0.001 - 40	PCB (total)
Aldrin		0.002		0.002				Aldrin
BHC		0.003		0.003				BHC
a-BHC		0.006		0.006				a-BHC
b-BHC		0.005		0.005				b-BHC
g-BHC		0.0002		0.0002				g-BHC
Chlordane		0.005		0.005				Chlordane
DDT (total)		0.007		0.007				DDT (total)
op+pp-DDT		0.008		0.008				op+pp-DDT
pp-DDD		0.008		0.008				pp-DDD
pp-DDE		0.005		0.005				pp-DDE
Dieldrin		0.0006		0.0006				Dieldrin
Endrin		0.0005		0.0005				Endrin
HCB		0.01		0.01				HCB
Heptachlor		0.0003		0.0003				Heptachlor
H-epoxide		0.005		0.005				H-epoxide
Mirex		0.007		0.007				Mirex
PAH (total)		4		4				PAH (total)
PAH (Individual)								PAH (Individual)
Anthracene		0.22		0.22				Anthracene
Benz[a]anthracene		0.32		0.32				Benz[a]anthracene
Benzo[k]fluoranthene		0.24		0.24				Benzo[k]fluoranthene
Benzo[a]pyrene		0.37		0.37				Benzo[a]pyrene
Benzo[g,h,i]perylene		0.17		0.17				Benzo[g,h,i]perylene
Chrysene		0.34		0.34				Chrysene
Dibenzo[a,h]anthracene		0.06		0.06				Dibenzo[a,h]anthracene
Fluoranthene		0.75		0.75				Fluoranthene
Fluorene		0.19		0.19				Fluorene
Indeno[1,2,3-cd]pyrene		0.20		0.20				Indeno[1,2,3-cd]pyrene
Phenanthrene		0.56		0.56				Phenanthrene
Pyrene		0.49		0.49				Pyrene
METAL								METAL
Cadmium	<6	0.6		***	0.78-2.5	0.18	<0.1 - 41	Cadmium
Lead	<40	31		31	0.0-13.1	11.9	<1.0 - 810	Lead
Zinc	<90	120		90	29.4-55.4	40.6	6-53000	Zinc
Mercury	<1	0.2		0.2	0.017		<0.01-55.8	Mercury
Copper	<25	16		16	5.1-11.8	4.6	0.5-280	Copper
Nickel	<20	16		***	8.5-21.1		3-300	Nickel
Cobalt			50	50 *		10.2		Cobalt
Iron	<17000	20000		***			2600-180000	Iron
Chromium	<25	26		25	11-23	21.8	4-680	Chromium
Manganese	<300	460		***			71-2800	Manganese
Arsenic	<3	6		***	8.4		0.86-36	Arsenic
Silver			0.5	0.5 *				Silver
Barium	20			20 *				Barium
CONVENTIONAL								CONVENTIONAL
COD	<40000		5%	40000				COD
Phosphorus	<420	600		420				Phosphorus
Ammonia	<75	100		75				Ammonia
Cyanide	<0.1	0.1		0.1 *				Cyanide
TKN	<1000	550		550				TKN

1. USEPA: USEPA Region V Guidelines for the classification of Great Lakes harbor sediments (1977)
2. MOEE: Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario (1992)
3. MOEE: Open Water Disposal Guidelines (1978)
4. USEPA: Rossmann, 1988 (As, Hg values unpublished). Lake St. Clair - Stable zone 12 Cores - Basin
5. USEPA/LLRL (unpublished) Detroit River - 1 core

Summary of General Considerations for Establishing Quantitative Sediment Objectives for the Detroit River

- Quantitative sediment objectives are of interest to several impairment topic areas for the Detroit River and may be used for protection of bottom dwelling organisms, as restrictions for dredging and disposal practices, and as target concentrations for mitigative and remedial actions;
- There are two primary sources of sediment quality guidelines for the Great Lakes and for the purposes of Detroit River objectives, the developmental history of both required examination;
- Development of MOEE guidelines are biologically-based and have been derived using state-of-the-art methods;
- There does not appear to be sufficient evidence that the parameters (5) carried over by the MOEE from the Open Water Disposal Guidelines are biologically based;
- There appears to be sufficient evidence that the 1968 FWPCA guidelines are biologically based and five parameters (five of ten) were retained, as stated, in the 1977 USEPA guidelines;
- There does not appear to be sufficient evidence that the 1977 USEPA guidelines, in part, should be considered biologically based;
- Additional anthropogenic substances and contaminants which were not initially examined by the workgroup have been identified and included in the objectives;
- Of the several hundred contaminants reported in the Great Lakes system, many have not been considered due to their omission in the 2 sources of guidelines and a lack of information regarding background conditions;
- Background conditions should be equal to or lower than conditionally accepted sediment quality objectives for Detroit River sediment to demonstrate achievable and feasibility of the guidelines;
- Background conditions need not necessarily be achieved for the protection of bottom dwelling organisms in the Detroit River;
- The paleolimnological approach for determining pre-European settlement background conditions (with associated caveats) should be the primary approach for determining background concentrations for heavy metals;
- The reference approach and the inference that organic contaminants should be below the limit of detection should be used for determining background conditions for organic contaminants;
- The conditionally accepted objectives for organic contaminants for Detroit River sediment quality are greater than background conditions determined using a reference approach and the theoretical approach that background conditions approach zero;
- Regional, pre-settlement averages of the Huron-Erie corridor should not be calculated due to differences in regional glacial history and geochemistry;
- Lake St. Clair and Detroit River background concentrations for heavy metals are the most appropriate for comparison of background and objective concentrations for the Detroit River, although concentrations from the Huron-Erie corridor should be generally examined.
- The conditionally accepted guidelines for heavy metal for Detroit River sediment quality are greater than background conditions.
- Sediment quality objectives for the Detroit river could not be established for Arsenic, Cadmium, Nickel, Iron and Manganese when compared to background conditions, or due to a lack of information.
- Sediment quality objectives for the Detroit River have been established from the MOEE and USEPA guidelines and their respective precursors, which are biologically based, the most stringent, and are achievable when background levels are considered.
- Sediment contaminant guidelines (MOEE and USEPA) for Cobalt, Silver, Barium, COD and Cyanide have been recommended as Detroit River Sediment Objectives which are not biologically based (biological criteria unavailable).

Contaminated Sediments Site Prioritization and Agency Activities

The Contaminated Sediments Workgroup has summarized the most recent sediment information pertinent to the Detroit River and updated the reference list of studies since the Stage 1 Report. This is presented in the update portion of the RAP document. Utilizing data from the latest system-wide survey, the workgroup also developed criteria to prioritize sites and choose hotspots.

Hotspot Identification and Prioritization

In order to identify those areas within the Detroit River which for one reason or another are deemed hotspots, a review of the most recent data was required. The source of information used by the Contaminated Sediments Technical Workgroup in determining sites was the report "Environmental Assessment of Detroit River Sediments and Benthic Macroinvertebrate Communities - 1991", MOEE-Beak, 1993.

The 1991 study results provided valuable information. In particular, the following results were relied upon:

1. Summary of the level of benthic macroinvertebrate community impact: Severely impacted, moderately impacted or slightly impacted.
2. Summary of the level of sediment contamination: Severely contaminated, moderately contaminated or slightly contaminated.
3. Sediment bioassay results using fathead minnow fry, *Chironomus tentans* and *Hexagenia limbata*.

Based on a review of this data, the Technical Workgroup developed a set of criteria in order to prioritize the most impacted sites. The following criteria was used:

Priority 1 Sites

a. sites which were identified as having severely impacted benthic macroinvertebrate communities and/or

b. sites which were identified as having sediment toxicity results of greater than 80% toxicity for one or more test species and/or

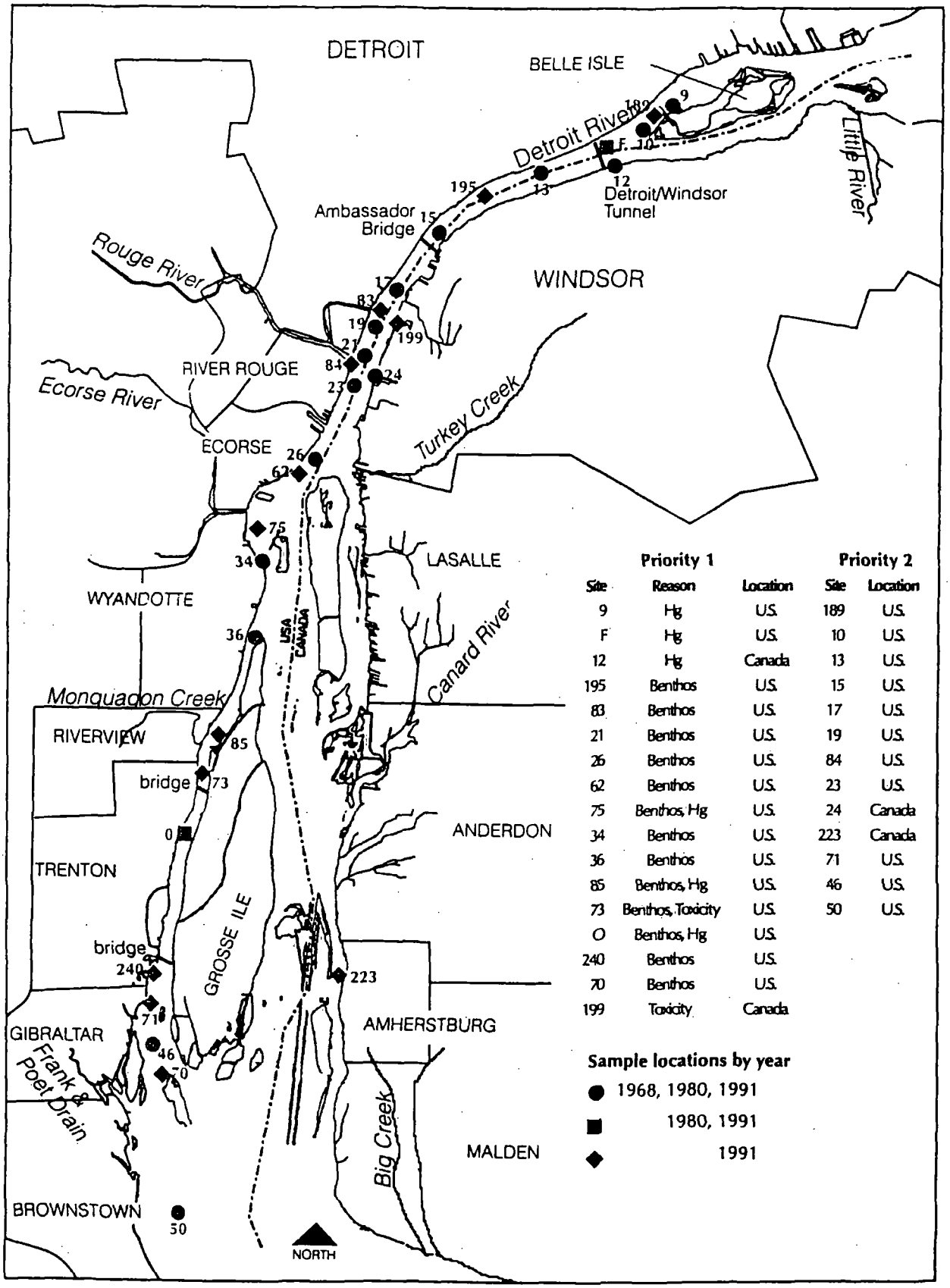
c. sites with sediments containing elevated levels (above the severe effect level) of any parameter identified by the fish consumption advisories (mercury and PCBs)

Priority 2 Sites

a. sites with sediment chemistry parameters other than mercury and PCBs in excess of the severe effect level.

Applying this criteria to the 1991 Detroit River data generated the following Priority 1 and Priority 2 sites (see following map).

Figure 6
Detroit River Priority 1 and 2 Hotspots.



Priority 1			Priority 2	
Site	Reason	Location	Site	Location
9	Hg	U.S.	189	U.S.
F	Hg	U.S.	10	U.S.
12	Hg	Canada	13	U.S.
195	Benthos	U.S.	15	U.S.
83	Benthos	U.S.	17	U.S.
21	Benthos	U.S.	19	U.S.
26	Benthos	U.S.	84	U.S.
62	Benthos	U.S.	23	U.S.
75	Benthos, Hg	U.S.	24	Canada
34	Benthos	U.S.	223	Canada
36	Benthos	U.S.	71	U.S.
85	Benthos, Hg	U.S.	46	U.S.
73	Benthos, Toxicity	U.S.	50	U.S.
O	Benthos, Hg	U.S.		
240	Benthos	U.S.		
70	Benthos	U.S.		
199	Toxicity	Canada		

Sample locations by year

- ● 1968, 1980, 1991
- ■ 1980, 1991
- ◆ 1991

Agency Updates of Sediment Related Activities

MDNR Activities

The Michigan Department of Environmental Quality – in conjunction with USEPA Region 5, USEPA GLNPO and USEPA LLRS – has initiated several sediment activities in the Trenton Channel of the Detroit River. These activities are collectively known as the Trenton Channel Project. The Trenton Channel was identified in the UGLCC Study and the Stage 1 RAP as the most polluted segment of the AOC in terms of degraded sediment. This was supported by the 1991 BEAK-MOEE Sediment and Benthic Assessment.

The goal of the Trenton Channel Project is to develop a process which will facilitate the assessment and remediation of contaminated sediments in large river systems. Once successful in the Trenton Channel, key components of the study can then be applied to rest of the AOC.

The Trenton Channel Project is concentrating efforts in two primary areas:

1. Developing a specific contaminant fate and transport mass balance model for the Trenton Channel (PCB and mercury); and,
2. Delineating the scope of currently known hotspot contamination (type of contaminant, volume and sources) and assessing contamination in previously unsampled areas.

Research begun in 1993 and continuing in 1994 and 1995 has included many studies that directly support the mass balance modeling effort and/or sediment hotspot assessment. These include:

1. Resuspension potential measurements made by the University of California-Santa Barbara in key depositional zones. This research sheds light on the erosion rates of sediments in Trenton Channel hotspots.
2. Sediment assessment using surfical and core sampling methods done by MDNR and USEPA. Sediment chemistry has included organics, metals, AVS/SEM, and searches for distinctive trace compounds.
3. Hydroacoustic profiling of sediments by Caulfield Engineering of British Columbia. This innovative technology has shown great promise as an assessment tool in delineating layers of contaminated sediment.
4. Ecosystem response of dredging in the nearshore area of the Trenton Channel studied by Michigan State University. Baseline benthic structure, sediment toxicity and sediment chemistry were performed in a recently dredged marina (Elizabeth Park Marina). Yearly follow up will shed light on the quality of sediments being deposited in the Trenton Channel and benthic community recolonization.
5. Low level contaminant loadings will be accessed in a joint effort by Michigan State University, USEPA-LLRS and MDNR. This project will encompass seasonal and flow variations in PCBs, Hg, Zn, and Pb contaminants in particulate and dissolved fractions. It will also look for sources of these contaminants using conventional and innovative techniques.

Proposed projects call for sediment assessment in areas upstream of current hotspots, development of the mass balance model components, and evaluating remedial technologies applicable to Trenton Channel sediments. Through the cooperation of state and federal agencies, the Trenton Channel Project will generate a greater understanding of contaminated sediment dynamics in the Detroit River.

MOEE Activities

Sampling Update

The Ontario Ministry of the Environment and Energy (MOEE) carried out further sediment quality investigations on the Detroit River during the summer of 1994. The following is a brief description of the areas sampled:

1. In partnership with the City of Windsor and the University of Windsor, the Ministry collected sediment samples from 18 sites located along the City of Windsor's waterfront area. Historical data (1991) indicated elevated levels of heavy metals (greater than SEL) at two sites within this

sampling area (stations 12 and 24; 1991 sites). Samples were split and are currently being analyzed by the City of Windsor and the University of Windsor.

2. The Ministry collected sediment samples from six sites in the vicinity of Allied Chemical where historical data revealed elevated levels of copper. These samples are currently being analyzed for heavy metals by the Ministry.
3. Sediment samples were collected from the immediate vicinity of two tributaries to the Detroit River; the Canard River and Turkey Creek. These sites were sampled in response to comments received by the BPAC that the 1991 study failed to assess the areas immediately adjacent to the tributaries. Samples are presently being analyzed for heavy metals by the Ministry.

USEPA Activities

Sediment Activities Underway at the Region 5 Water Division

Region 5 has been working on contaminated sediment issues for over a decade, but these activities rapidly accelerated in 1990 with the creation of the Region 5 Sediment Initiative. To better pursue regional concerns about risks associated with contaminated sediments, the Water Division expanded the role of its In Place Pollutant Task Force (IPPTF) with the addition of members collectively representing Clean Water Act, RCRA, CERCLA, TSCA and other authorities. As this was done, Region 5 also recognized the need to broaden our base to include external communications/coordination with designated sediment contacts within other federal (i.e. Corps and USFWS) and state agencies. Building on these relationships we've now been able to significantly improve regional and agency-wide sediment assessment, prioritization and remediation efforts.

A Description of the IPPTF

Primarily the IPPTF provides technical consultation and project management at the request of divisional programs and other federal and state agencies.

IPPTF's emphasis is primarily on:

- Region 5 Sediment Initiative
- Single & Multi-Media Sediment Remediation Actions
- Geographic Initiatives
- Forum Reviews on Rules, Regulations, Risk, Criteria, Data, Impacts, and QA/QC
- Forum Review of National Sediment Strategy, Sediment Criteria, and ARCs
- Support for Corps Navigational Project Reviews
- Special Projects
- General Technical Consultation

Members and Participants number around 40 with personnel from Water, Planning & Assessment Branch, Waste (RCRA & CERCLA), ESD (Monitoring, QA/QC, and TSCA), Counsel, GLNPO, and Air. The group also receives participation by one or more sediment staff from each of the six states within Region 5.

Current IPPTF sediment activities supporting the Region 5 Sediment Initiative and beyond (with many parallel at the National level) are:

- National/Regional Contaminated Sediment Sites Inventory
- National Sediment Criteria
- Prioritization System for Contaminated Sediment Sites
- USEPA and USEPA/States Remediation of Sediment
- Joint USEPA/Army Corps of Engineers Sediment Enforcement/Remediation
- Guidance Document for Disposal of Contaminated Sediment
- Sediment Contamination Prevention/Remediation Pilot Projects
- CWA Section 404 National/Great Lakes Test Guidance Document for Dredged Materials

- Sediment Quality-Based Permits
- Opportunities For Remediating Contaminated Sediments Through Natural Resource Damage Assessment Process
- Calculating Biota-to-Sediment Accumulation Factors
- Sediment-Based Risk Assessments/Cleanup Goals
- Statistically-Based Sediment Sampling Guidance
- Model Sediment Sampling Quality Assurance Project Plan

A Description of the Sediment Management Team

To further advance the sediment efforts of the Water Division, IPPTF, and the Region 5 Sediment Initiative, a small team of technically diverse staff was formed. Under management by the Senior Technical Advisor to the Director of the Water Division, this Sediment Management team delivers technical advisory services for IPPTF activities and beyond; basically, those requiring management of the regional sediment program. To date, the team operates out of the Water Division's front office as it provides cross-divisional, cross-regional and statewide technical support.

Aside from supporting IPPTF projects listed above, other activities of the Sediment Management team include:

- Support to Regional RAPs and LaMPs projects
- Support of CWA Enforcement Cases Involving Sediment Remediation
- Support of Sediment Issues at Superfund NPL and SACM Sites
- Support to RCRA and TSCA Sediment Issues
- Development/Implementation of a Regional Sediment Enforcement Training Program
- Support to GLNPO's Assessment and Remediation of Contaminated Sediments (ARCs) Program

USEPA Region 5 Interim Contaminated Sediment Site Prioritization

In order to help evaluate the nature and extent of contaminated sediments, the United States Environmental Protection Agency (USEPA) Region 5 has undertaken the development of an Inventory of Contaminated Sediment Sites (the Inventory), with some financial support from Headquarters and Coastal Environmental Management funds. The primary goal of the Inventory is to consolidate into one repository sediment-related information that has been collected by numerous federal, state and local agencies for sites within the Great Lakes region. This information will be used for a variety of purposes including:

- to help determine the magnitude and distribution of sediment contamination in the Region (including the Great Lakes Basins);
- to identify problem areas and sites which need more assessment;
- to aid in prioritizing sites where prevention, remediation, and enforcement actions are needed;
- to supplement other priority setting efforts of USEPA and the States, among them the identification of the Great Lakes Areas of Concern; and
- to serve as a framework for USEPA's National Sediment Inventory.

The Region 5 Inventory thus far includes summary information for over 500 sites within the States of Minnesota and Wisconsin, and the basins of Lakes Superior, Michigan, as well as Southeast Michigan waterways and portions of the Ohio and Mississippi Rivers. The Inventory does not include all available data points for a given site, but presents a summary (e.g., minimum, maximum and median values) of sediment chemistry, sediment bioassay and fish tissue information. In addition, other site summary and characterization information (e.g., latitude and longitude, receiving waters, fish advisories issued, known impacts, etc.) is provided in the Inventory.

In order to prioritize sites within the Inventory for future assessment and remediation actions the Region 5 Water Division formed a Sediment Prioritization Workgroup (workgroup) under the direction of the Chairman of the In Place Pollutant Task Force, to formulate a process by which to evaluate sites. The primary charge to this group was to develop a process to identify a list of sites from the Inventory which were contaminated, but were receiving little or no attention.

The Prioritization Workgroup developed a two-tiered scheme. The first tier only uses information in the Region 5 Inventory and is primarily intended to substantially narrow down the number of sites to be investigated further in the second tier. In the second tier, other information (e.g., formal site-specific reports) is used to evaluate the sites in addition to what is contained in the Inventory. The workgroup's approach considered parameters included in other prioritization processes such as Superfund's Hazard Ranking System and the International Joint Commission's fourteen beneficial use impairment criteria for designating Great Lakes Areas of Concern. Interim products from the first and second tiers were reviewed by the Region 5 States and the USEPA Region 5 In Place Pollutant Task Force.

The Prioritization System described was essentially an internal effort to help focus additional attention where needed for sediment sites throughout Region 5, as well as provide a starting format for States/RAPs and other groups trying to prioritize contaminated sediment sites. This system was presented to the Detroit River RAP Sediment Workgroup and was part of the numerous sources drawn upon in developing the Stage 2 Detroit River RAP Sediment Quality Objectives (SQOs). Results of the Region 5 Prioritization system where omitted from this document because they are extraneous to the well-developed, site-specific recommendations made by the RAP's Contaminated Sediment Workgroup.

Information Needs

The Contaminated Sediments Workgroup identified Modeling and a Contaminated Sediments Database as tools needed to process information and make decisions. The need to model contaminant fate and transport within the Detroit River AOC was established. A search was conducted to identify existing models that were applicable to the needs for Stage 2. Two models, Wayne State's Atmospheric and Sediment Deposition Model (ASDM), and MOEE's KETOX Model were chosen to be pursued by the workgroup, [Table 14 (from Lin, 1994)].

The **ASDM Model** is an unsteady-state model capable of predicting the fate of contaminants in many compartments including the water column, sediments, and biota. Being of an unsteady-state, it has the dimension of time and can answer how long it will take a parameter to reach a certain level in the sediments under a given loading condition. Wayne State University, along with the MDEQ is looking at ways to fund the ASDM model for use as a planning tool in the remediation of sediments in the Detroit River.

The **KETOX Model** can predict the fate of contaminants in the water and sediment. It is a steady-state model with funding provided by MOEE. The Contaminated Sediments Workgroup chose to model the 6 parameters of concern used by the PS/NPS and CSO TWGs with the MOEE Ketox Model.

Modeling the Water Column Sediment and Biota Concentrationsof the Detroit River with ASDM

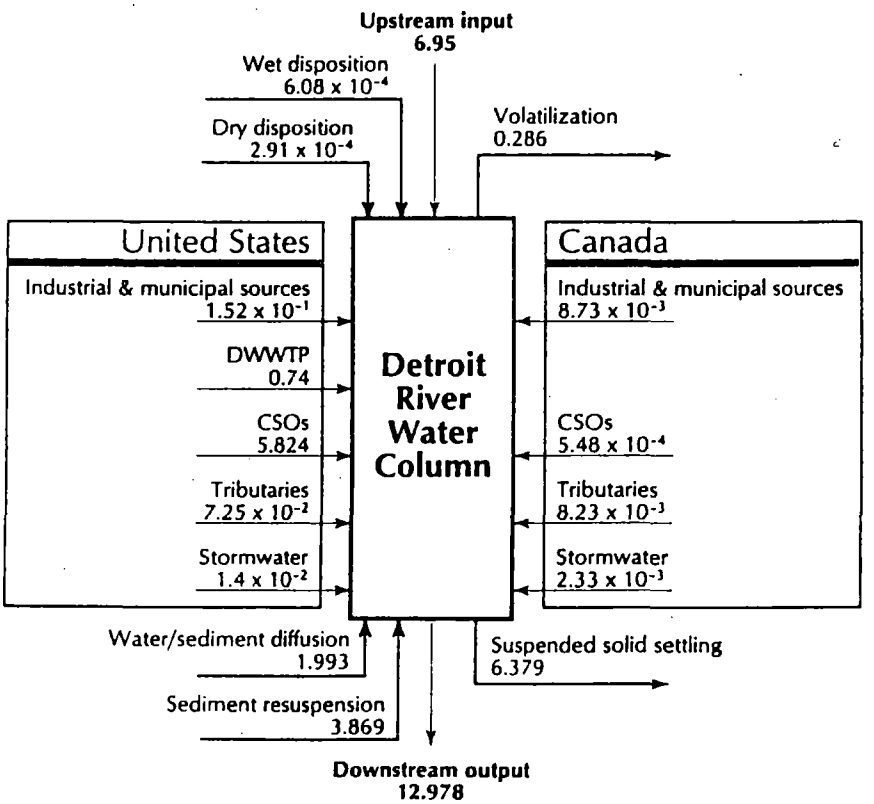
Wayne State University's ASDM is a generalized temporal and spatial transport and fate model for predicting water, sediment, fish, suspended solid, plankton, porewater and benthos phase contaminant concentration profiles in the river. The model includes water column and surface sediment advection and dispersion, multimedia contaminant transport processes, intermedia contaminant partitioning processes, and contaminant transformation processes.

Three compartment (air, water, and sediment) contaminant interaction source/sink rates, and contaminant sorption effect of water and porewater exposure to suspended solids, plankton, fish, sediment and benthos can be calculated from this model and applied to the water and sediment equations of continuity in one, two and three dimensions for both steady state and transient conditions. Two equations of continuity for the water column and surface sediment can be solved by the Finite Difference Method, Crank-Nicolson Method [1], and Iteration Method. The model computer program USSMPX[2] is run on a SUN work station and MTS utilizing databases.

The most important six models are compared with this model (ASDM) by author, source, layer, partitioning process, transport process, and transformation process (See Table 14). The advantages of the ASDM model include surface sediment flow, a food chain model, and parameter estimation.

The ASDM model can be used to identify potential sources or sinks of contaminants among three compartments (air, water, and sediment), and to quantify contaminant loading rates from air/water diffusion, dry deposition, wet deposition, water/sediment diffusion, suspended solid settling, sediment resuspension and burial in the river system. The major sources for mercury in the Detroit River water column, according to the ASDM model, are upstream input (51%), combined sewer overflows (43%), and Detroit Wastewater Treatment Plant (5%). The major sinks for mercury in the Detroit River water column are downstream output (94%), deposition to sediment (4%), and volatilization to air (2%). The Detroit River water column is a source of mercury for Lake Erie, river sediment, and air. In addition, the Detroit river water column overall mercury mass balance showed that the total input is equal to the total output. The ASDM model which is a mass conservation model can accurately predict contaminant fluxes among three compartments (air, water and sediments).

Figure 7
ASDM Results — Detroit River Water Column Mercury Mass Balance Result
(Sediment Flow, 1983-1991. Predicted CSO flow rates)



All measurements are shown in kg/day

Total input = 19.64 kg/day Total output = 19.64 kg/day

The ASDM can also be used to predict water, sediment, suspended solid, plankton, fish, porewater and benthos phase contaminant concentration profiles in the river aquatic and sediment systems. The steady state model results showed that all Detroit River water mercury concentrations exceed Michigan's Rule 57(2) Criteria (0.6 ng/l); the UGLCC study also found the same results. In addition, regression analysis for steady state sediment mercury give a general indication of goodness of fit (Regression Line Slope = 1.3, Regression Line intercept = 0, Regression Coefficient = 0.6. The steady state model outputs also showed that most of large fish methyl mercury concentrations are above the MOEE Criterion, similar to the fish methyl mercury concentrations in Lake St. Clair.

Table 14
Model Comparison Table

MODEL	WASPS	TOX14	TOXFATE	QWASI	SMCM	ASDM	KETOX
AUTHOR	Ambrose (1991)	Ambrose (1991)	Halton (1990)	Mackay (1989)	Cohen (1990)	Lin (1992)	McCorquodale (1992)
SOURCES	WASP TOXIWASP WASTOX WASP4	EXAMS2 WASP4	Hydrodynamic				
LAYERS	surface water subsurface water surface benthic subsurface benthic	water benthic benthic	water sediment	water sediment	water sediment	water surface sediment deep sediment (surface sediment flow)	water active bed
PARTITIONING PROCESSES	water ⇅ sand, silt & clay porewater ⇅ sediment dissolved organic carbon	chemical ⇅ ionic water ⇅ sand, silt & clay porewater ⇅ sediment	water X plankton/fish X suspended sediment porewater X sediment/ benthos	water ⇅ sediment porewater ⇅ sediment PARTITION COEFFICIENT ESTIMATION	water X biota X suspended sediment porewater ⇅ sediment	water ⇅ plankton/ small fish ⇅ large fish ⇅ suspended solid porewater ⇅ sediment/ benthos	water ⇅ biota ⇅ fine solid ⇅ coarse solid porewater ⇅ coarse sediment
TRANSPORT PROCESSES	advection dispersion volatilization water/sediment diffusion wet deposition settling resuspension sediment burial	advection dispersion volatilization settling resuspension sediment burial	advection dispersion volatilization	advection dispersion air/water diffusion water/sediment diffusion dry deposition wet deposition settling resuspension sediment burial	advection dispersion air/water diffusion water/sediment diffusion dry deposition wet deposition TRANSPORT PARAMETER ESTIMATION	advection dispersion air/water diffusion water/sediment diffusion dry deposition wet deposition settling resuspension sediment burial	advection dispersion settling resuspension sediment burial
TRANSFER PROCESSES	biolysis *hydrolysis* oxidation photolysis	biolysis *hydrolysis* oxidation photolysis				biolysis *hydrolysis* oxidation photolysis	biolysis *hydrolysis* oxidation photolysis

⇅ = equilibrium X = nonequilibrium

KETOX (D4SEDS) Model Methods

The hydrologic modelling technique used as a basis for simulating the hydrodynamics of the Detroit River is referred to as Lagrangian. This form of hydrologic investigation provides time series data relative to a specific parcel of water as it changes its location with time.

The Detroit River KETOX ("D4SEDS") model is designed to simulate the far-field region of a contaminant plume. At this point the plume is vertically well mixed and chemicals are diluted by additional stream flow, i.e. longitudinal and transverse mixing. The river is divided into segments, referred to as "REACHES". Reaches are numerical representations of distinct channels in the river. The reaches are further subdivided into "Cross (X-) Sections". The exact position of individual point source discharges are then referenced within this framework. A series of physical, chemical and biological transport and transformation processes, to determine the "fate" of a contaminant within the river, are empirically incorporated into the model using a collective kinetic loss coefficient.

Steady-state modelling (e.g., the KETOX model) simulates a single scenario (i.e. a single river flow rate and single [set] of loading conditions) per model run per specified contaminant, (Appendix 8.1 Table N). Various combinations of loading rates and river flow can be used to simulate loading impacts to the water column, suspended solids and bed layer (i.e. upper sediment layer - depth = 3 cm).

Should one model simulation, based on an average loading rate and average river flow rate prove insufficient, a statistical approach, known as "stochastic modelling", can be used to better characterize the fate and transport of contaminants in the river. This method incorporates the variability inherent in flow and loading rates. A distribution of predicted concentrations in the water column, suspended solids and sediment phases is thereby generated.

Sediment Phase Sub-Model

The sediment phase sub-model of the KETOX Model is limited to the mathematical simulation of contaminant concentrations within the "Active Bed Layer (i.e. suspended and bed sediments)". Three different particle groups are stipulated, i.e. "Biotic/Fine Abiotic/Coarse Abiotic Particles", for this layer.

1986–90 Loading Data By Reach and Category of Point Source Discharge

The results of the modelling work are presented in three different formats. The first set of results provides a clear "picture" of the relative importance, with respect to total contaminant loadings, each reach and category of point source discharges has on the Detroit River (Appendix 8.1 Table O).

"D4SEDS" KETOX Model Output

Dispersion Mass Balance; Mass Rates Into and Out Of Each Reach

The third set of model results provides information related to the transport of the contaminants within the various reaches of the Detroit River, as demonstrated by the whole water (i.e. unfiltered water) concentrations of each contaminant. The "HEAD" refers to the Lake St. Clair region of the river. The contaminant mass associated with the head is referred to as the "Upstream input". The "MOUTH" refers to the Lake Erie region of the river. In this case, mass represents the "Downstream output" from modelled sources only. Data from all nonpoint sources to the river is unavailable (Appendix 8.1 Table P).

To determine the "NET" change in the mass (or quantity) of a contaminant attributed to point sources within the Detroit River, during CSO discharge periods, subtract the "HEAD" mass entering into the River from the "MOUTH" mass entering into Lake Erie. For example:

For PCBs: the quantity of PCB attributed to loadings into the Detroit River = 9.23 - 0.70 = 8.53 kg/day.

Important Point to Remember:
Model runs were carried out to determine the impact of all point source discharges to the Detroit River. Therefore, this mass of PCBs represents that mass which would enter Lake Erie when CSO discharges occurred. The mass would be smaller, obviously, on "nice sunny days" when CSO discharges were zero.

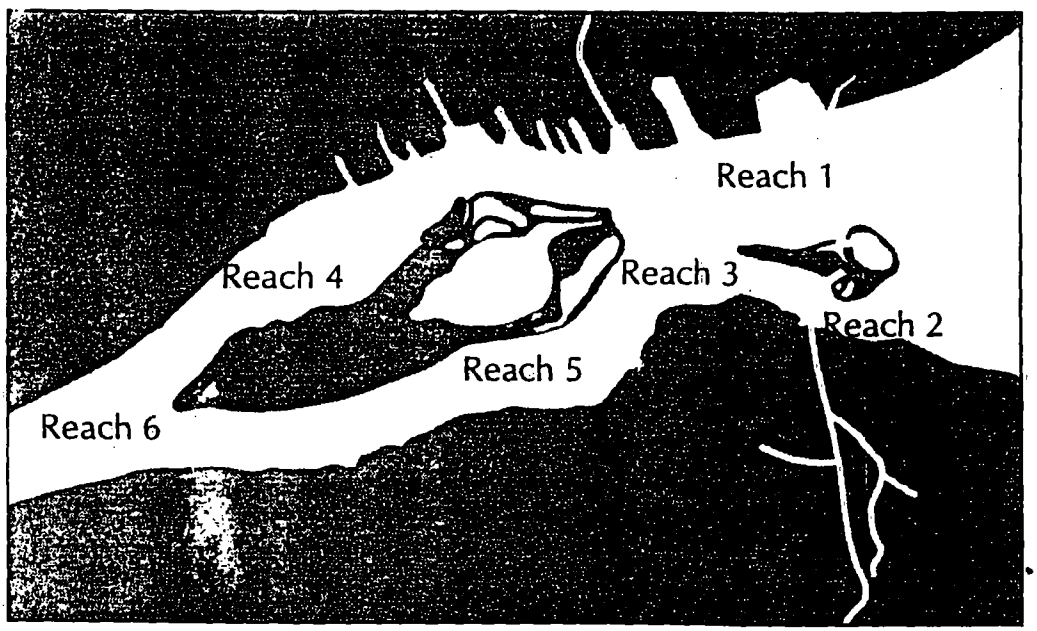
Information available for individual CSOs included:

1. Number of Events per Year (CSO specific);
2. Total Volume per year (CSO specific);
3. Average Duration of Event (CSO specific);
    a. FLOW PER EVENT (in cubic feet per second) was calculated from the above three-mentioned pieces of information.
    b. Concentration Data, on a contaminant specific basis, was obtained from published literature.

An EVENT SPECIFIC LOAD RATE on a CSO specific basis was derived from A * B.

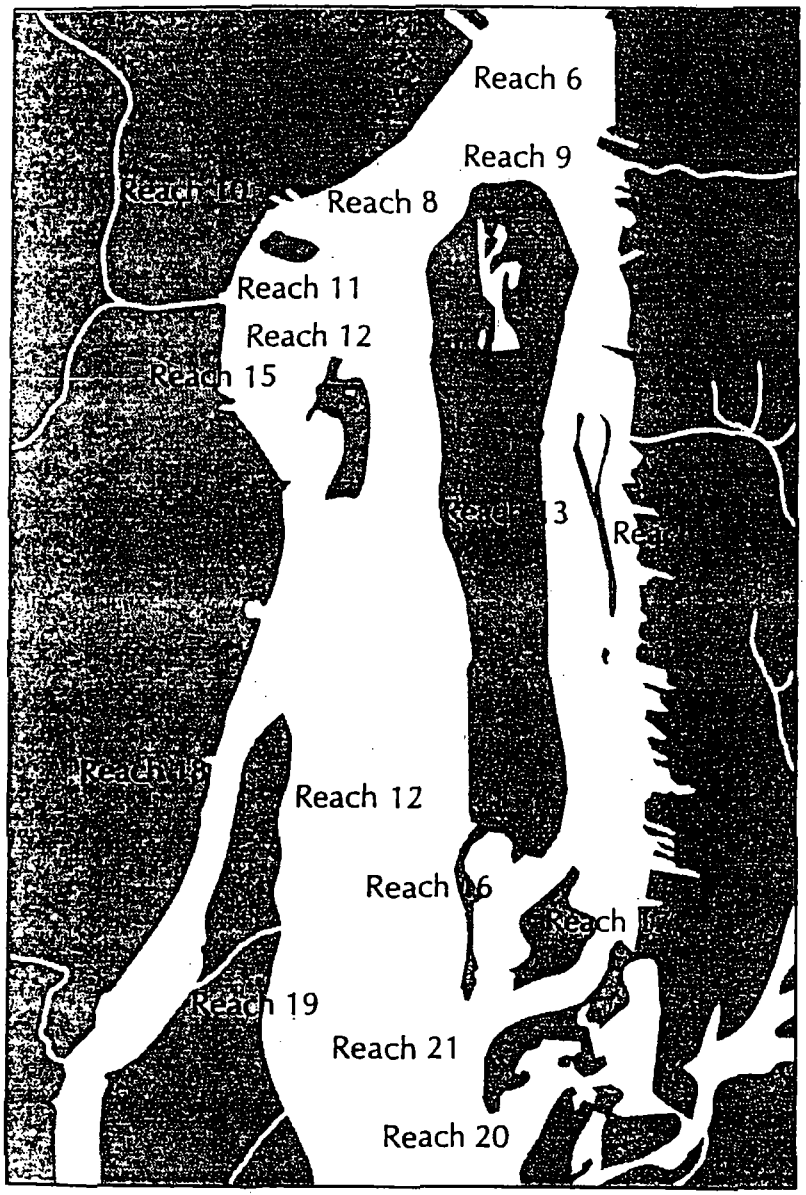
The number of events for an individual CSO ranges from 7 events per year for the LEIB (B08) CSO to 48 events per year for a number of them; the MEAN NUMBER OF EVENTS PER YEAR = 30.4, n = 41. The duration of each event ranges from 0.17 day (4 hours) for the St. Aubin (B13) CSO to 1.63 days (39 hours) for Conners Creek CSO; the MEAN DURATION OF EACH EVENT = 0.53 day (12.7 hours), n = 41.

Figure 8
Detroit River AOC Reaches 1 through 6



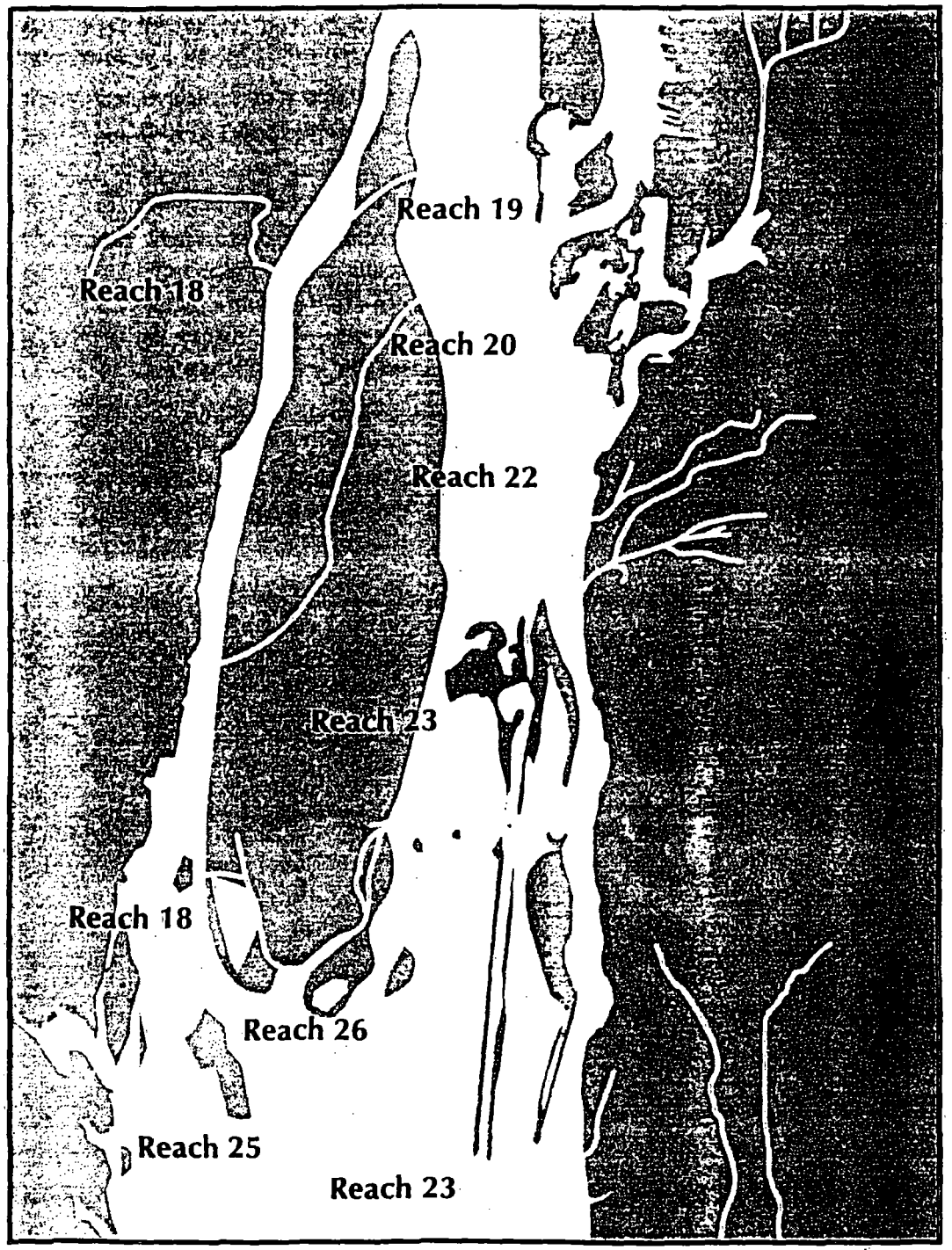
Source: MOEE Environmental Monitoring and reporting science and technology.

Figure 9
Detroit River AOC Reaches 6 through 20



Source: MOEE Environmental Monitoring and reporting science and technology.

Figure 10
Detroit River AOC Reaches 19 through 23



Source: MOEE Environmental Monitoring and reporting science and technology.

As has been pointed out in the preceding text, CSO discharges are intermittent point sources. These point sources discharge a load to the river on an average 30 times per year for a duration of approximately half a day.

A new proposal was raised to reduce CSO/SS loading rates by a factor of 12. The rational brought forth for undertaking this action was to more or less reflect a continuous flow as is normally associated (assumed) with industrial and municipal point sources. It was suggested that the loadings would thereby more closely reflect a yearly loading average. It would be prudent to determine the exact nature of the variations to an industrial/municipal point sources' effluent characteristics prior to undertaking action to reduce contaminant loadings associated with CSO/SS discharges.

Discussion and Conclusions

Assessment of the Quality of the Loading Data

Loading data were obtained from the Detroit River Stage I RAP Report (June 1991) and DWSD model development status report by Camp Dresser & McKee, September 30, 1993. In many cases annual loading data were used to calculate a contaminant's concentration; or to infer a specific point source flow rate.

It should not be interpreted as suggesting point source loading data is adequate. The currently available point source data is satisfactory for providing some guidance on the relative significance of individual point source loadings to the river. The available data permits a clarification of the relative significance of each Reach, with respect to contaminant loadings. Further runs of the Ketox model using updated loadings will permit a more focussed analysis of loadings to the river.

"D4SEDS" KETOX Model Output — Dispersion Mass Balance

The initial set of model predictions, for each contaminant, represents 100 percent of the MEAN estimate of the 1986 to 1990 contaminant loading rates. These loadings are discharged to the Detroit River flowing at the MEAN 1986 to 1990 flow (i.e. 203,694.99 cu.ft./sec.). The second and third sets of model predictions represent contaminant mass fluxes based on 25% and 50% reductions, respectively, of contaminant loadings from major Michigan combined sewer overflows (CSOs). The fourth set of model predictions assumes that absolutely "No Loadings", i.e. VIRTUAL ELIMINATION, from Detroit River point sources occur. Therefore, the only source of a contaminant load is attributed to Lake St. Clair.

From Tables N and P, Appendix 8.1, it is possible to determine the reaches which experienced the largest mass loading of a particular contaminant, due to the modeled point sources, during the modeled time frame.

For PCBs: Reaches 4 and 6 receive the largest loads; mainly from CSO discharges.

For Lead: Reaches 4, 5, 6 and 18 receive the largest loads; mostly from CSO discharges, together with the Rouge River.

For Copper: Reaches 4, 6 and 24 receive the largest loads; mostly from CSO discharges, together with the Rouge River.

For Zinc: Reaches 4, 5, 6, 18 and 24. Loadings in this case appear to be more or less shared between CSO/SS and Industrial/Municipal sources, together with the Rouge River.

For Cadmium: Reaches 4 and 6 receive the largest loads; mostly from CSO discharges, together with the Rouge River.

"D4SEDS" KETOX Model Predictions for Whole Water, Suspended Solids, Surficial Sediments Versus Field Measurements

Contaminant concentrations have been predicted for whole water (i.e. unfiltered water sample), suspended solids and surficial sediments (upper 3 cm. of the bed layer). The results of the model predictions can be found in Appendix 8.1, table O. Reaches have been identified and segmented in distance downstream (feet) along the horizontal axis of the river from the start of the reach.

The contaminant specific Lowest Effect Level (LEL) and Severe Effect Level (SEL) concentrations for each contaminant were incorporated into their respective tables. Surficial sediment concentrations at Stations 177, 178 and 180, which are based on loadings exclusively from Lake St. Clair, were examined. It was concluded that the Lowest Effect Level (LEL) is closely approached for total PCBs and lead at the start of the Detroit River. A possibility exists that the LELs for copper, zinc and cadmium would be exceeded through Lake St. Clair loadings alone.

Based on field measurements of contaminant concentrations in the water column, suspended solids and bed layer versus model predictions, it is concluded that current model predictions are representative of loading impacts to the Detroit River, over the period modelled.

Assessment of the Quality of Model Predictions

It is possible to discern steep concentration gradients perpendicular from the Michigan shoreline (Node 15) to Mid-Channel (Node 8) and on to the Ontario shoreline (Node 1). Node 12 to Node 15 represents eight (8) percent of the river flow closest to the Michigan shoreline. The above-mentioned direction is mainly intended for reference purposes for those reaches entirely in Ontario or Michigan waters. The close "hugging" of the contaminant plume along the Michigan shoreline agrees very well with the results of previous modelling work.

The Ketox model predicts beneficial use impairments to benthos and restrictions on dredging due to contaminant loadings associated with point sources in Reach 4, i.e.: Connors Creek CSO, Freud P.S. CSO, Fairview P.S. CSO, McClellan (BO3) COS, Fisher (BO4) CSO, Iroquois (BO5) CSO, and Helen (BO6) CSO.

The "D4SEDS" Ketox model demonstrates the magnitude of contaminant loadings from Michigan outfalls to the Fighting Island Channel (Reach 12), the Livingstone (Reach 23) and Amherstburg (Reach 24) Channels. Contaminant fluxes into and out of the Trenton Channel (Reach 18) and Fighting Island Channel (Reach 12) are very similar (Appendix 8.1, Table P). The difference lies in the flow rates for these two channels.

Trenton Channel flow rate: 42,776 cu. ft./sec.

Fighting Is. Channel flow rate: 103,884 cu. ft./sec.

The contaminant mass per unit volume of water is much greater for the Trenton Channel (i.e. higher contaminant concentration) than for the Fighting Island Channel. This is expected, due to the nature of the contaminant plume "hugging" the Michigan shoreline. The contaminant load down the Fighting Island Channel is approximately equal, due to the much greater volume of water flowing down this channel versus the Trenton Channel, (Reach 23, Reach 24).

Summary of KETOX Recommendations

1. Loading data, preferably flow rate and contaminant concentration, should be obtained in a manner to properly assess the exact characteristics, with adequate precision, of the point source loadings (i.e. industrial, municipal, CSO or storm sewer).
2. A field sampling program should be designed in a manner to properly coincide (i.e. in the correct temporal framework) with the collection of pertinent upstream loading data.
3. The Ketox model should be updated with the Ketox 2 version (graphics output) and run using the most current loading estimates.

Contaminated Sediments Database

The compilation of a central contaminated sediments database is critical now that sediment assessment in the Detroit River is in the forefront of activities performed by various agencies and consultants. The U.S. Army Corps of Engineers (ACOE) is developing this database under the direction of U.S. EPA Region 5 (USEPA) in cooperation with the Michigan Department of Environmental Quality (MDEQ). Funding for the project comes from USEPA via an inter-agency agreement between the two agencies. The database includes all sediment chemistry information from the Detroit River as well as the Rasin, Rouge, Huron and Clinton Rivers.

After hearing recommendations made by the Detroit River RAP Contaminated Sediment TWG to focus on addressing contaminated sediment issues in the Trenton Channel, USEPA, ACOE, and MDNR decided that the database should be expanded to include a GIS-mapping capablility. this effort is underway in the form of remapping the Trenton Channel to overlay contaminated sediment data and other relevant information to support furthur assessment, modeling, prioritization and remediation decisions

Surface Modeling of Sediment Data for Rouge and Detroit Rivers (Michigan) Using GIS Technologies

The U.S. Army Corps of Engineers (US ACOE), Detroit District, initiated work in 993 to support the USEPA-Region 5, under the Southeast Michigan Initiative (SEMI). SEMI is a multi-media (air and water) program to identify pollution sources and enforce compliance with federal statutes. The US ACOE will provide both agencies with a geographic information system (GIS) for importing, analyzing, modelling, and displaying contaminated sediment sampling data for the SEMI region. The SEMI project area includes the Detroit River, as well as the Clinton, Huron, Rouge, and Raisin River Watersheds. A tentative work plan outlines several tasks which consists of selecting base maps, inventorying sediment sampling data, designing the data base structure, populating the relational data base management system with sampling data, and creation of visualization techniques using surface modelling tools.

A pilot study was undertaken regarding the Detroit River and bottom sediment data acquired by the USEPA in 985. The base map for the Detroit River was derived from design files available at the US ACOE, Detroit District. Although a more elaborate data base file structure will eventually be implemented, the pilot data base consisted of three data files which included the sample station location, sampling information, and parameter data. Using a Unix-based Intergraph work station and the Modular GIS Environment (GIS) family of software, several visualization techniques were developed. These visualization techniques can involve planimetric and isometric views as well as single and multiple parameters. Preprocessing with gridding and statistical tools provide for normalization and spatial display of the sampling data. As a preliminary conclusion, the functionality of the visualization techniques are limited by the density of sampling data and the robustness of the available surface modelling tools.

In view of this pilot study, the following interim conclusions are suggested:

- Further coordination between the US ACOE, USEPA, MDNR, and MOEE is needed in regard to sediment sampling methods.
- The spatial density of the sediment sampling grid needs to be increased.
- The SEMI project database has to be finalized, populated and documented.
- A customized user interface needs to be developed with linkages to Arc/View and/or Microstation compatible PC software.
- Surface modelling and contouring routines will require additional developmental effort.
- Sediment sampling displays should be referenced to CSOs, municipal water intakes, industrial storm water outfalls, current land use, wetlands and two-dimensional flow models of the Detroit River.

In Place Remedial Measures

Currently identified in the Michigan's Sites of Environmental Contamination list (April 1994 for Fiscal Year 1995), progressing towards sediment remediation in the Detroit River is Monguagon Creek, site ID number 820216 in category 3 with a SAM score of 34. Pursuant to Michigan's Act 307, Potential Responsible Parties (PRPs) have been notified and work plans for further assessment have been submitted.

Background Information and Site History

Monguagon Creek is a tributary to the Detroit River Trenton Channel. There is one tributary to the creek, Huntington Drain. Huntington Drain is an urban storm drain that serves the City of Riverview. The total length of the Creek is approximately 0.7 miles. The creek has received wastewater discharges from industrial facilities as well as surface runoff from the town of Riverview. The only current industrial discharger to the creek is Elf Atochem North America, Inc. (formerly, Pennwalt Chemical West Plant). That site has been involved in the production of pesticides, phenols and organic amine compounds.

The Detroit River Area of Concern identified Monguagon Creek as a site of environmental contamination pursuant to Act 307 because of the contaminated sediments in the Creek. According to MDNR's report dated April 3, 1991, the sediment in Monguagon Creek is highly polluted with heavy metals such as mercury, chromium, zinc, and lead and numerous organic contaminants including PCBs, phenols, heptachlor, hexachlorobenzene, and extractable oil and grease.

Site Status

The MDNR sent Potential Responsible Party (PRP) notification letters to owners of property adjacent to Monguagon Creek on July 1, 1991. In the letter, MDNR requested the PRPs to voluntarily undertake corrective actions to remedy the environmental and human health problems at the site by fencing the site, conducting a remedial investigation, performing a feasibility study, and implementing a final remedial action. In August, 1991, the creek was fenced as a method of restricting public access.

On October 5, 1992, Firestone Tire and Rubber Company conducted an investigation of surface water and sediment quality adjacent to their landfill area. Based on this investigation, Firestone Tire and Rubber Company concluded that they are not a PRP. MDNR has not officially determined Firestone Tire and Rubber Company's PRP status.

The Superfund Section of Environmental Response Division collected water and sediment samples from the creek at ten different locations on July 20, 1993. The raw data is available for review. The BASF Corporation submitted on August 31, 1993 a work plan for sampling water and sediments upstream and downstream of their railroad bridge. On September 24, 1993, MDNR recommended that the Company coordinate their study with Elf Atochem to avoid duplication of sampling locations. However, the Company decided to wait for the Elf Atochem's sampling results to pursue their work plan.

Elf Atochem North America, Inc. submitted on July 19, 1993 a work plan for sampling water and sediments in the creek between the Elf Atochem plant and the mouth of the creek. Upstream sampling locations were also proposed. The work plan of Elf Atochem was approved on November 3, 1993. Elf Atochem North America, Inc. performed the sampling as proposed on November 30 and December 1, 1993. The MDNR split water and sediments samples at two locations (#3 and #5) with the Company. The sediment samples from location #5 were black and oily and had a very strong odor of organic chemicals.

On May 11, 1994, Elf Atochem submitted their site investigation report to MDNR. Based on this study, the Company concluded that potential chemicals of concern include benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, ideno(1,2,3-cd)pyrene, 2,4-di-tert-pentyphenol, lead, zinc, and PCB Aroclor 1260. The Company also proposed further investigation of

the creek. The purpose being to collect specific data on; a profile of the Creek; depth of constituent migration, if any, into the underlying native clay; bottom elevations along Huntington Drain; and average and maximum flows of Huntington Drain.

On July 6, 1994, MDNR and Elf Atochem had a meeting to discuss MDNR's review of Elf Atochem's investigation report and a need for a feasibility study. Elf Atochem had conducted the additional studies of the creek that they proposed in May. The additional work indicates that; the contaminated sediments have not impacted the native clay underlying the creek; the profile of the bottom of creek is flat, so flow rate and direction of flow in the creek depends on the water level in the Detroit River; the predicted storm flows in Huntington Drain are 339 cubic feet second (cfs), 797 cfs, and 1067 cfs for the 2-year, 25-year and 100-year storm events, respectively; the estimated sediment volume in the creek is 15,000 cubic yards.

Elf Atochem's investigation reports were well done and comprehensive and are acceptable to MDNR.

Based on the MDNR review of all the various studies, there are a number of potential parameters of concern. Two of the more significant are zinc and 2,4-DP. These two were found at elevated levels at all sampling locations.

Feasibility Study

Elf Atochem submitted an outline of a proposed feasibility study on July 6, 1994. The outline of the proposed feasibility study was acceptable. The Company will submit the proposed feasibility study by the end of November 1994.

Future Response Needs

MDNR is in the process of renotifying the potential responsible parties to voluntarily undertake corrective actions to remedy the contamination in the creek. The MDNR will review the proposed feasibility study and evaluate remediation options after they are submitted.

Monitoring and Surveillance Plan

The monitoring and surveillance (M/S) plan developed by the Contaminated Sediments Technical Workgroup is a binational multi-staged tiered strategy for assessing the status of sediment quality in the Detroit River.

The main stages of the plan involve AOC assessment, AOC trend analysis, Hotspot site/Sensitive area evaluation, and remedial action monitoring. The main tier components of the M/S plan include benthic community, sediment chemistry, and sediment toxicity/bioaccumulation testing.

AOC Assessment: Tier I, II, III, IV

System-wide sediment surveys in the Detroit River were conducted in 1985 by the USEPA/MDNR and 1968, 1980, 1991 by MOEE. The Detroit River RAP Contaminated Sediments Technical Workgroup recommends a 5 year cycle in assessing the sediment quality of the Detroit River AOC, with the next survey beginning in 1996. MDEQ and MOEE should be responsible in coordination of this effort and bringing resources of other agencies together.

Tier I involves the sampling of benthic community populations in approximately 80 stations in the Detroit River (Figure 3.1 Beak-MOEE). Using multivariate cluster analysis as in the "Beak-MOEE:Environmental Assessment of Detroit River Sediments and Benthic Macroinvertebrate Communities-1991", 1993., sites would be distinguished as unimpacted, severely, moderately, or slightly impacted.

Once a site has been deemed impaired with respect to benthos, a sampling plan using a number of problem definition strategies would be developed. Taking into account any historical site information, Tier II would involve taking sediment chemistry samples including conventional, organic, and inorganic parameters, and methods including total and leachable, to help solve the reason for impaired benthos

at a specific site. Using biologically-based criteria such as MOEE: "Guidelines for the protection and management of Aquatic Sediment Quality in Ontario", 1993., a determination can be made if particular parameters may be involved in degrading a site.

If sediment chemistry results cannot account for the benthic degradation, then sediment toxicity sampling using Daphnia magna (eight hour immobility), *Chironomus tentens* (10d growth) and/or Microtox (photobacterium) would be used to confirm the cause of the degradation is contamination. (Giesy, J.P. and R.A. Hoke. 1989.) The use of caged fish studies (Fathead Minnow) should also be made available as a tool to access bioaccumulative affects.

Tier III Hotspot/Sensitive Areas of Interest and Tier IV Remedial Action Monitoring should be initiated by agencies as needed. The data should be made available to organizations involved in Detroit River sediment sampling.

AOC Trend Analysis

Fifty eight stations were identified in the BEAK-MOEE, 1993 report with temporal contaminant trends. The proposed 1996 survey should include several of these stations as part of continued trend analysis.

Hotspot/Sensitive Area Evaluation

Both MDNR and MOEE have informed the CSED TWG of ongoing sediment investigation in the Detroit River to further identify hotspots and to characterize the sediments in areas of interest.

MDNR and USEPA are coordinating efforts to assess contaminated sediments in the Trenton Channel area of the Detroit River. Core and surficial sediment sampling took place in 1993 and 1994 at known contaminated sites and in wetland/habitat areas.

MOEE has taken sediment samples in hotspot areas of the Detroit River on the Canadian side in 1994 to confirm contamination and determine possible sources.

The 1996 survey should include hotspots and sensitive areas as identified by the agencies. The survey should also solicit proposed sites from the BPAC and general public.

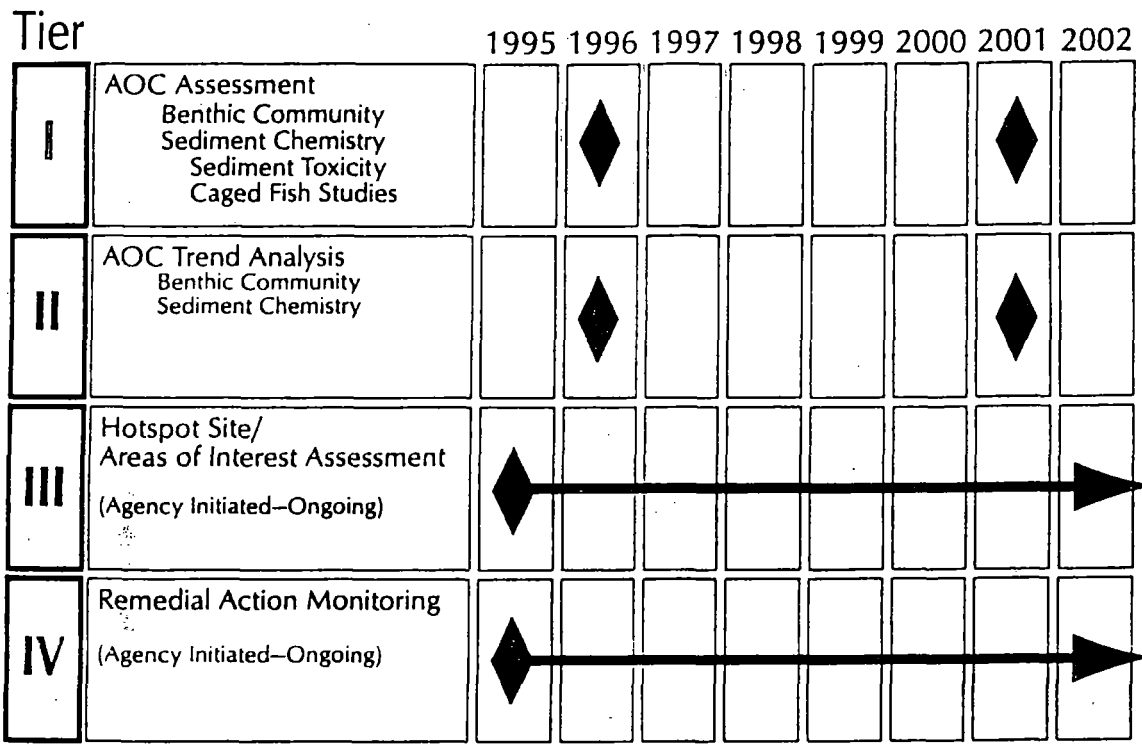
Remedial Action Monitoring

Michigan State University is currently monitoring sediment chemistry, sediment toxicity, and benthic community structure at a site recently (1993) dredged in the lower Trenton Channel. The study will assess the impact of dredging on these elements over several years.

Coordination

Agencies, industry and municipalities involved in sediment assessment need to communicate their methods and results to avoid duplication and further the goals of restoring the beneficial uses impaired by contaminated sediments. Discussions on a Contaminated Sediments Database and Graphic Information Systems are addressed in the Information Needs section of the Contaminated Sediments Technical Workgroup Report.

Figure 11
Overview of Monitoring and Surveillance Plan Stages/Tiers



Agencies and Municipalities Involved in Sampling Sediments in the Detroit River AOC

United States
City of Detroit
MDNR – Michigan Dept. of Natural Resources
US ACOE – U.S. Army Corps of Engineers
USEPA – U.S. Environmental Protection Agency
US F&WS – U.S. Fish & Wildlife Service
USGS – U.S. Geological Survey

Canada
CCG – Canadian Coast Guard
City of Windsor
DFO – Dept. of Fisheries & Oceans
EC – Environment Canada
ERCA – Essex Regional Conservational Authority
OMNR – Ontario Ministry of Natural Resources
MOEE – Ontario Ministry of Environment & Energy

Remedial Options

The Contaminated Sediments Workgroup has compiled a reference list of appropriate documentation with regards to potential sediment remediation technologies. The workgroup recognizes that certain source control remedial options are being developed by the CSO and PS/NPS Workgroups.

Realizing that without additional field data to determine the extent of contamination, without modeling efforts tied to sediment fate and transport trends, the workgroup chose not to recommend specific remedial options for individual contaminated sediment areas. The mechanism for the remediation of contaminated sediments in Michigan (Act 307) also precludes the workgroup from making specific remedial option determinations.

The current reference list includes:

- Workshop on the Removal and Treatment of Contaminated Sediments
- Environment Canada's Great Lakes Clean-up Fund, 1993.
- Sed-Tech Database of Remedial Technologies, 1994.
- Detroit River Technical Options Study. MOEE (Beak), 1993.
- Remediation of Contaminated Sediments. USEPA, 1991
- Workshop on Innovative Technologies for the treatment of Contaminated Sediments. USEPA, 1990.
- Selecting Remedial Techniques for Contaminated Sediments. USEPA, 1993.

Estimates of Sediment Remediation Costs at Selected Sites in the Detroit River

The cost estimates provided in this discussion are preliminary. They have been calculated for discussion purposes and would require considerably more detail and investigation if actual costs were calculated for remediation. The calculations are based upon approximations of surface area, volume, and cost range. In each case, a range of values have been calculated to approximately bound the range of area, volume, and cost estimates. These scenarios or bounds are intended for discussions to examine the magnitude of potential fiscal resources required for mitigation/remedial action of sediments.

Remedial costs for sediments will ultimately require consideration in the RAP process and are usually substantial. If each of the 43 Great Lakes Areas of Concern (AOC) required remediation of 1,000,000 cubic yards of sediment each, the total estimated cost at $250 per cu yd is projected to be in excess of $10 billion. Actual and estimated sediment remediation costs for individual sites in AOCs are expected to cost in the multi-million dollar range (e.g. $60 M). An estimate for the lower Detroit River has been previously calculated at $1.5 M, but is considered to be very conservative. Various cost estimates for particular remedial actions are used in these calculations: $50, $350, and $1000 per cubic yard. These values are general cost estimates for capping, advanced treatment, and hazardous waste disposal, respectively. These are used for discussion purposes and other sediment remediation techniques and cost estimates (potentially higher and lower) could be used for planning estimates. There are usually other infrastructural or logistic costs associated with a remedial action which may include ship construction, maintenance, and operations, personnel training, transport of sediments, pre-treatment, disposal area construction and maintenance, effluent treatment, etc. which may impact the above cost estimates.

A range of calculations are provided for a relatively small site in the Trenton Channel and a large reach of the lower Detroit River to contrast costs within and between sites. Calculations are provided for: 1) a site in the mid-section of the Trenton Channel known as the Black Lagoon and 2) the western nearshore zone of the Detroit River from the Rouge River to Lake Erie which encompasses the Trenton Channel. Both areas have a history of impacts which include degraded benthos, relatively high sediment contaminant concentrations, and have exhibited toxicity in several toxicity testing procedures. Both areas examined also have considerably degraded sediments with depth.

1. The first site considered is located in the central portion of the Trenton Channel on the western (mainland) shore of the State of Michigan. The site, commonly referred to as the Black Lagoon, is known to be a depositional basin, and a degraded condition of sediments has been documented.

The zone of interest is a small embayment and depending on the map used, varies in shape and surface area. Estimates for an upper and lower surface area (dependent on the morphology used) and a mean of the two estimates are provided for calculations. Past and recent studies have indicated highly contaminated sediments at depths of two to three yards and are used for volume calculations; depth of the contaminated material will vary with location within this site. The intent would be to remove sediments to a depth which would, at a minimum, not expose a more contaminated level, negate any side-slumping of contaminated sediments, and would desirably yield concentrations which would adhere to those established for quality sediments. Cost estimates for the Black Lagoon are presented below.

Table 15
Estimated Sediment Remediation Costs for the Black Lagoon, Trenton Channel, Detroit River

	Surface Area (square yards)	Depth (yards)	Volume (cubic yards)	Cost	Total Cost (million $)
1.	6500	NA	NA*	50/sq. yd.	0.3
2.	6500	2	13000	350/cu. yd.	4.5
3.	6500	2	13000	1000/cu. yd.	13.0
4.	6500	NA	NA*	50/sq. yd.	0.3
5.	6500	3	19500	350/cu. yd.	6.8
6.	6500	3	19500	1000/cu. yd.	19.5
7.	9000(ave)	NA	NA*	50/sq. yd.	0.5
8.	9000(ave)	2	18000	350/cu. yd.	6.3
9.	9000(ave)	2	18000	1000/cu. yd.	18.0
10.	9000(ave)	NA	NA*	50/sq. yd.	0.5
11.	9000(ave)	3	27000	350/cu. yd.	9.5
12.	9000(ave)	3	27000	1000/cu. yd.	27.0
13.	11,250	NA	NA*	50/sq. yd.	0.6
14.	11,250	2	22500	350/cu. yd.	7.9
15.	11,250	2	22500	1000/cu. yd.	22.5
16.	11,250	NA	NA*	50/sq. yd.	0.6
17.	11,250	3	33700	350/cu. yd.	11.8
18.	11,250	3	33700	1000/cu. yd.	33.7

*NA= not applicable; capping technique

Cost estimates vary considerably dependent on surface area, depth, volume, and method cost. At approximately $50 per square yard, cost ranges from $0.3M to $0.6M; at $350 per cubic yard, cost ranges from $4.5M to $11.8M; at $1000 per cubic yard, cost ranges from $13.0M to $33.7M.

2. The second area considered is the western nearshore zone of the Detroit River extending from the Rouge River, south to Lake Erie. This area is considered for an examination of a large-scale, sediment remedial action and has a documented history of contamination and impacts. For the calculation, the north-south transect or length is estimated to be approximately 15 miles (=26,400 yd). The shoreline is undoubtedly irregular in this zone and the length used is an estimate. Two estimates for width are provided (from the shoreline moving east) at 10 and 25 yd. These have been estimated and the width sediments in potential need of remediation varies considerably when the meander of the river and embayment/tributary areas are considered. An average of 1 yd sediment depth is used for the calculation considering that certain areas may be scoured and other areas are depositional. Cost estimates used are those presented earlier.

Table 16
Estimated Sediment Remediation Costs for the Lower Detroit River in the Western Nearshore Zone, Rouge River to Lake Erie, Including the Trenton Channel

	Length (yards)	Width (yards)	Depth (yards)	Volume (cubic yards)	Cost	Total Cost (million $)
1.	26400	10	1	NA*	50/sq. yd.	13.2
2.	26400	10	1	264000	350/cu. yd.	92.4
3.	26400	10	1	264000	1000/cu. yd.	264
4.	26400	25	1	NA*	50/sq. yd.	33
5.	26400	25	1	660000	350/cu. yd.	231
6.	26400	25	1	660000	1000/cu. yd.	660

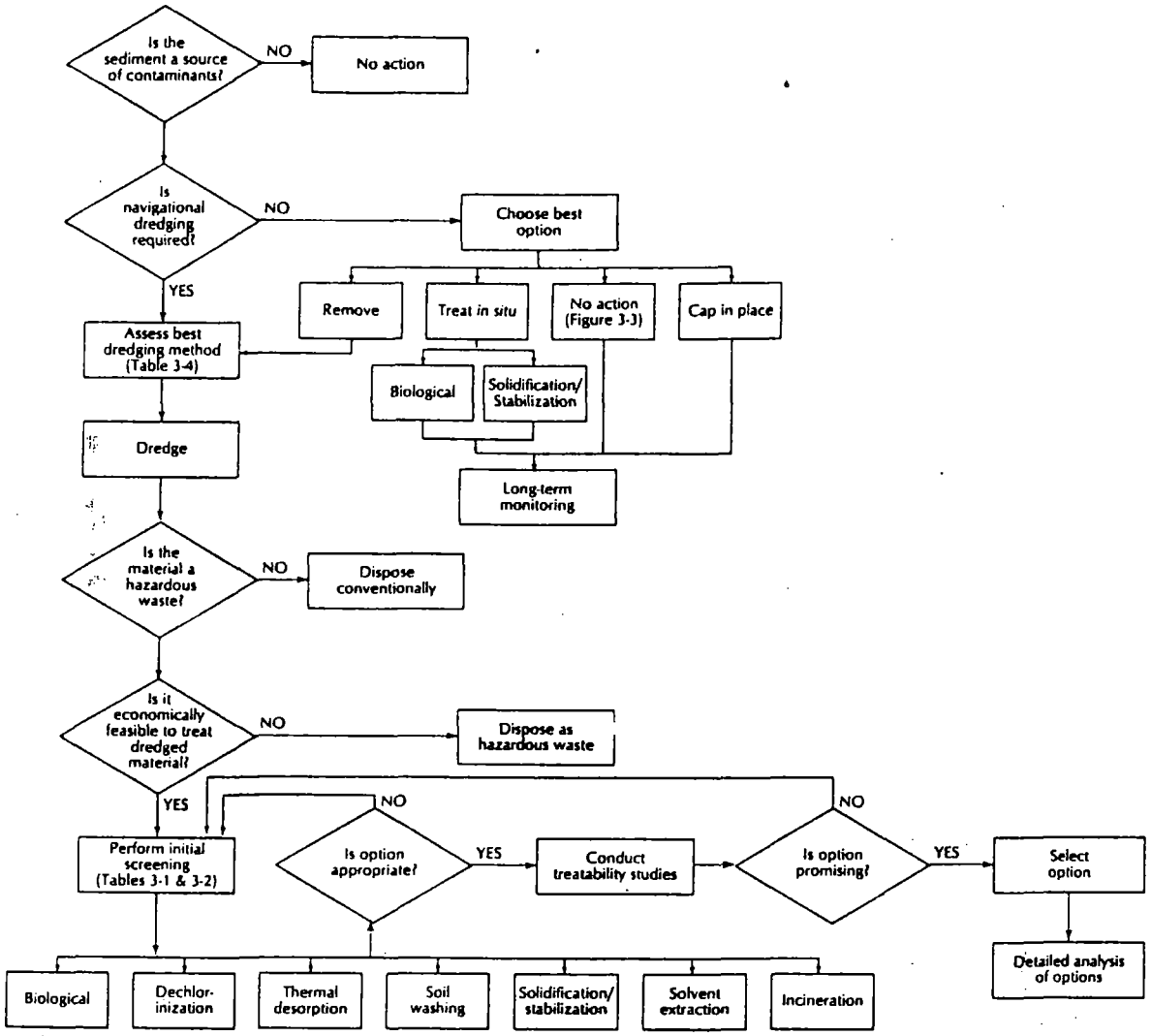
* NA = not applicable; capping technique

Again, cost estimates vary considerably dependent on surface area, depth, volume, and method cost. At approximately $50 per square yard, cost ranges from $13.2M to $33M; at $350 per cubic yard, cost ranges from $92.4M to $231M; at $1000 per cubic yard, cost ranges from $264M to $660M.

As would be expected, estimated costs associated with the larger area are considerably greater than those of the smaller site. Estimated costs for large-scale, sediment remediation range from $13.2 to $660 M; costs for a smaller site range from $0.3 to 33.7 M. These estimates indicate that the costs for sediment remediation can be substantial and must be considered in the RAP process. When considering an expenditure of this magnitude in a benefit-cost framework, a reasonable degree of certainty must be demonstrated that the remediation will be a long-term, sustainable action and that the probability of site recontamination is very low.

The Detroit River Technical Options Study (BEAK) examined many of the remedial technologies currently available. A summary of full-scale contaminated sediment treatment options and evaluation criteria (Bewtra et al., 1992) is presented from the report.

Figure 12
Remedial Options Decision Flowchart



Source: USEPA; *Selecting Remediation Techniques for Contaminated Sediment, 1993).*

Table 17
Summary of Evaluation Criteria for Full-scale Contaminated Sediment Treatment Options

Technology	Target	Application	Cost	Effectiveness
Indirectly heated thermal desorption	all organics	Europe	moderate-high	very effective
Lurgi travelling grate pelletizing process	all organics & inorganics	Europe	low	very effective
ABR/CIS microbiological *In situ* treatment	selected organics	Europe	moderate	mod. effective for organics
SILT bacteriological remediation	selected organics	Europe	low-moderate	very effective for organics
IHC rotary kiln incinerators	all organics	Europe	high	highly effective for organics
OES circulating bed combustor incinerator	all organics	USA	high	highly effective for organics
Desorption & vapor extraction (DAVE) system	VOCs & hydrocarbons	USA	N/A	very effective for organics
Mobile pit cleaning unit (PCU)	all organics	USA	N/A	very effective for organics
Chem-Matrix stabilization/solidification	all substances	North America	N/A	very effective
Krofchak solidification & stabilization	metal	Canada	low	very effective
Silt fixation	metal	Europe	low–moderate	effective
ToxCo chemical fixation & stabilization	metals & hydrocarbons	USA	low	effective
Beaver dredging pretreatment	all contaminants	Europe	low	effective
Bergman soil/sediment washing	all contaminants	Europe	moderate-high	effective
DJN dewatering	all contaminants	Europe	low	effective
IHC froth floatation	all organics & metals	Europe	high	very effective
Silt fraction separation & dewatering	all substances	Europe	low	effective
Vacuum & pressure filtration/dewatering	all substances	USA	low-moderate	very effective
DJN floatation	all substances	Europe	low	moderately effective
Melt-all electric fusion process	organics, radioactives & metals	Europe/Japan	moderate	effective
Phosphate fixation	selected	Europe	N/A	very effective

N/A = not available

(Bewtra et al, 1992. Virtual Elimination of Persistant Toxic Substances from Contaminated Sediments. Report prepared fot the International Joint Commission).

Proposed Detroit River Confined Disposal Facility

Background

The Detroit River is a major international shipping/navigational route which is subject to natural deposition of sediment. Periodic dredging of the lower river, on both sides of the Canadian/United States border, is required in order to maintain the shipping channels. Dredged material from this river is generally considered contaminated and is currently disposed of inside the U.S. Army Corps of Engineers' Confined Disposal Facility (CDF) at Pointe Mouillee, Michigan. The Canadian Coast Guard, as the Canadian agency responsible for shipping channels, has identified the need for a long term use CDF to be located in Canadian territory that will meet the lower Detroit River dredging needs for Canadian portions of the channel. Most dredging in Canadian water occurs in the Lower Livingstone and Amherstburg Channels.

In recognition of this need, the Canadian Coast Guard initiated a CDF site selection study in 1991. Their site selection study identified seven sites which would potentially meet the Canadian dredged material disposal needs in the lower Detroit River area. A detailed review of the seven sites, on the basis of technical, environmental and cost considerations, reduced the number of potential sites to three.

As the next planning step, it is intended to proceed with an initial assessment of the three alternative sites in accordance with the Environmental Assessment and Review Process (EARP) Guidelines Order of 1984. Also, a "do-nothing" alternative will be evaluated in the initial assessment.

Facility Design

The proposed CDF would be designed to contain about 1.5 million cubic meters of dredged material. This design should meet the dredged material disposal needs for approximately 25 years. The basic layout would be a multi-cell arrangement comprised of an overall rock perimeter dike, internal cross dikes forming internal cells, a decant area and an unloading dock facility. Access to the dock would typically require excavating a channel of sufficient width and depth to permit entry of barges.

Candidate Sites

The Phase 1 of a Site Selection Study for a Confined Disposal Facility at Amherstburg, Ontario (MacLaren Engineers, 1991) considered eight candidate sites in the lower Detroit River and recommended the following three candidate sites for further study.

Candidate Site #1

Candidate Site #1 is located at the southern end of Fighting Island. Up until 1980, this site was used for disposal of propylene oxide production byproducts and calcium carbonate waste slurry. The southern-most of three diked containment was identified as a potential CDF site.

Candidate Site #2

Site #2 abuts the western berm of the Upper Livingstone channel and is located southwest of Amherstburg in the Township of Malden. The area is situated between the international boundary to the west and the western berm of the Livingstone shipping channel to the east.

Candidate Site #3

Site #3 is adjacent to the south end of Boblo Island, directly across from the Town of Amherstburg. The boundaries are Boblo Island to the north, the Upper Livingstone shipping channel (downbound) to the west, and the west berm of the Amherstburg shipping channel (upbound) to the southeast.

Following the completion of the initial assessment and assuming a suitable site can be selected, construction would likely take place in 1995 or 1996.

Implementation

Priority Contaminated Sediments Areas

Key aspects concerning implementation of contaminated sediment remedial measures in the Detroit River are site location, source control, funding, and the cost/benefits associated with remediation. The primary implementation for the majority of the contaminated sites is the Michigan Environmental Response Act (MERA) 1982 PA 307 (now referred to as Part 201 of Act 451 of 1994). Act 307 requires the Department of Natural Resources to identify, evaluate, and rank all sites of environmental contamination in the state based on a site assessment which evaluates the risk a site poses to public health and the environment (please see discussion on page 61 of this document). The Act provides for an objective approach to site ranking by requiring the application of a numerical risk assessment model. The sediments of the Detroit River have been ranked collectively (no individual sites) with a score of 34 out of a worst-case 48. There is no similar corresponding legistation in Ontario.

The Contaminated Sediments Workgroup has prioritized the list of hotspots in Section 2 of this report for immediate individual Michigan Act 307 site consideration from MDNR, and immediate attention from MOEE. Sites from the 1991 MOEE (Beak) Survey with Mercury levels above the SEL (Severe Effect Level - MOEE Aquatic Sediment Guidelines) were targeted. This level is 2 ppm/dry weight. If the immediate upstream or downstream station also had elevated levels of Hg, (1/2 the SEL), 1 ppm/dry weight, then the sites were grouped.

The rationale behind using Mercury for prioritization over other parameters is because it is bioaccumulative and has pathways to humans via fish consumption. This is an impaired use in the Detroit River. The workgroup is aware that the majority of the contamination in the Detroit River directly impacts the benthos and indirectly impacts human health. The workgroup prioritized the indirect human health pathway above those of direct impairement to benthic communities in constructing this priority list.

The following Hg Zones are proposed for immediate Michigan Act 307 or Canadian Action:

U.S. Sites

Hg	Zone 1: Sites 9 & 189	South tip of Belle Isle
	Zone 2: Sites F & 13	Cobo Hall to Free Press
	Zone 3: Site 75	Ecorse Channel
	Zone 4: Site 85	Upper Trenton Channel
	Zone 5: Site O	Lower Trenton Channel

Canadian Site

Site 12	Downstream of Railway dock

These zones are prioritized threats to the Detroit River ecosystem as related to mercury contamination. Sources to these zones, whether historical or current, appear to be partially of local origin. Levels of Hg are close to or below the LEL (Lowest Effect Level) immediately upstream of each impacted area. As an example, five sites at the head of the Detroit River all have Hg levels below the LEL. Sources to these Zones should be confirmed with a remedial investigation. In all cases, it will be up to the agencies to determine responsible parties at individual sites.

It is evident that to fully restore the use impairments "Restrictions on Dredging" and "Degraded Benthic Communities", many actions in the vicinity of the Detroit River watershed need to be completed. Timelines for action in the St. Clair River (year 2000), Clinton River, Rouge River (permits-2005), Detroit CSOs (control-2035) have direct impact on when the sediments in the Detroit River will be free from impact.

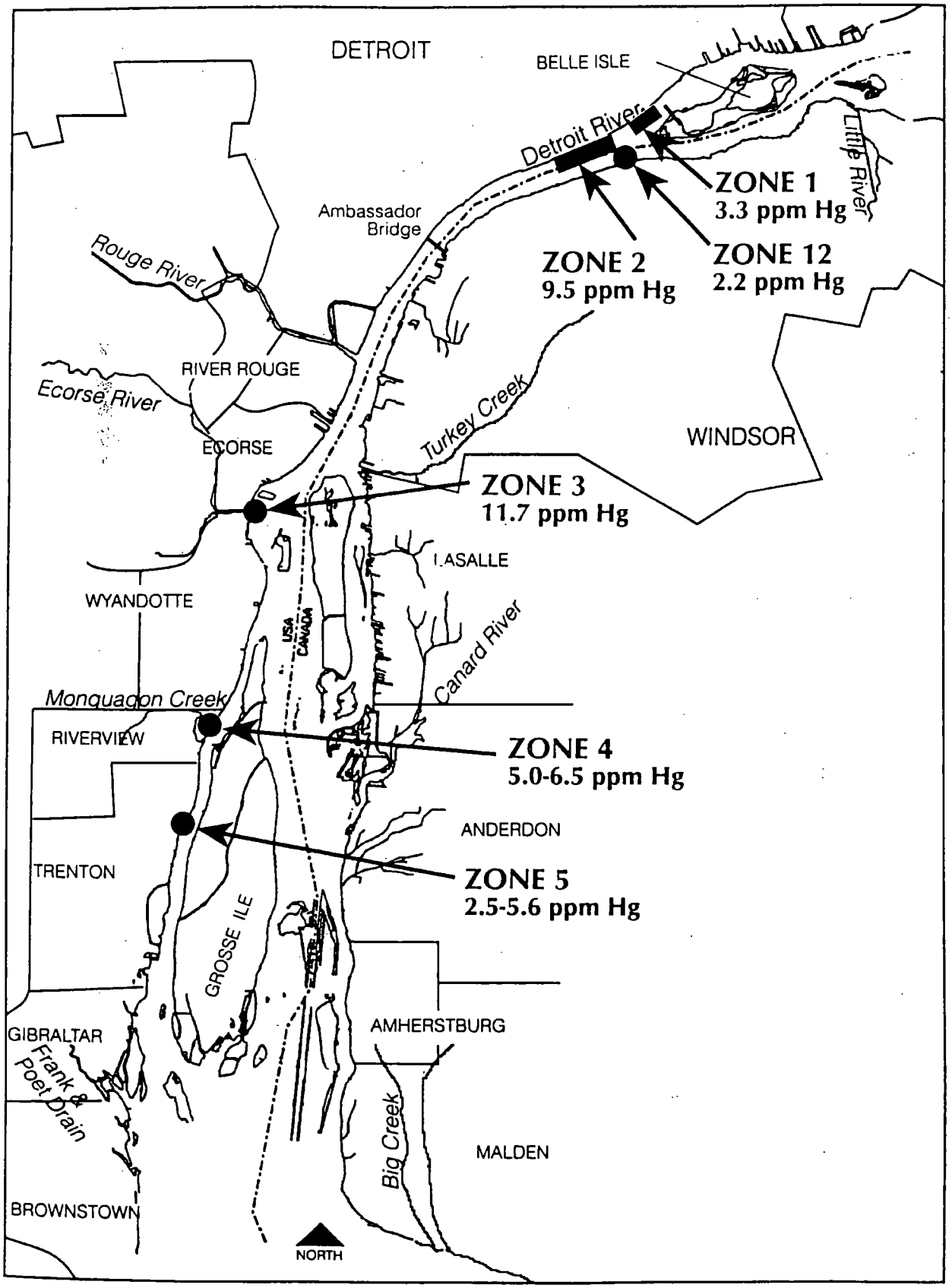
With the workgroups prioritized list of hotspots, immediate attention can be focused on those areas that are the highly contaminated above levels that current sources can account for. These sites can be progressively eliminated as sources of impairment to the AOC.

Other funding references applicable to contaminated sediment assessment and remediation include:

- Michigan RAP Financial Planning Guide. MDNR (Apogee Research Inc.) 1993.
- Ontario Potential Funding Mechanisms for Implementation of Remedial Action Plans and their Impact on User's,
- Beneficiaries, Polluters, and Society. MOEE (Hickling), 1992.
- Inventory of Ontario Provincial Funding Programs Applicable to Remedial Action Plans. MOEE, 1991.

There are also programmatic avenues to accomplish remediation objectives. One such effort is the Southeast Michigan Initiative, SEMI.

Figure 13
Canadian and U.S. Mercury zones



The Southeast Michigan Initiative

The United States Environmental Protection Agency (USEPA) and the Michigan Department of Natural Resources (MDNR) have launched a geographic initiative in the Southeast Michigan area because of the magnitude of contaminant releases and human population in the area. The Southeast Michigan Initiative (SEMI) area is defined as St. Clair, Macomb, Oakland, Livingston, Washtenaw, Wayne, Lenawee, and Monroe Counties.

There are several aspects to SEMI. One aspect is to approach environmental problems with flexibility and innovation that are not necessarily addressed by the traditional regulatory approach. Another aspect is to concentrate available resources from participating programs, as much as possible, on activities in the area that will result in a reduction of the overall risk to human health and the environment. The USEPA and MDNR recognize that in order for the SEMI to be fully implemented, that a Federal and State partnership must be secured.

The Cross-Media Geographic Approach

Concerns regarding environmental quality and the impacts of pollution are not media of facility specific. Citizens are concerned about the overall quality of their environment. Traditionally, environmental regulatory programs have focused on specific media and individual facilities.

The identification of Areas of Concern and the associated development of Remedial Action Plans, as well as the development of multimedia Lakewide Management Plans, has stimulated our Agencies to look at environmental problems from a geographic perspective. At the same time, we have recognized that most of our agencies program activities have been focused on individual facilities. However, in the natural world, pollution does not stop at the boundary of a facility, nor does it nicely remain in one medium. A facility, by itself, may be releasing contaminants at a rate which meet Federal and State standards, but taken in sum with its neighbor s releases, creates pollution at unacceptable levels. Furthermore, our focus on single media has led to pollution controls which sometimes merely transfer the pollution from one medium to another.

The Southeast Michigan area is major population center and numerous pollution sources in close proximity. The cross media focus of the Initiative will allow our individual programs to have a synergistic effect on the whole geographic area. Concurrently, the SEMI will initiate pilot programs to address environmental problems holistically.

Concentration Base Program Resources

In all likelihood, the Initiative will accelerate base programs in the Initiative area. It is recognized that the initiatives acceleration of a base program in the SEMI area may necessitate the re-prioritization of activities and the redirection of funds from other geographic areas of Michigan or the rest of Region 5 states.

Developing a Public Involvement Strategy for SEMI

The agencies will develop a public involvement strategy with the local communities concerning environmental issues, including prioritization of environmental programs, environmental risk, and issues of environmental justice. The strategy will be based on a dialogue that will keep the public informed about their environment, informed about and involved in agency decision-making where appropriate, and will inform the agencies about needs, issues, concerns, and priorities of the people whose environment the agencies are mandated to protect. The general public, local agencies, interest groups, and the regulated community will be included in the public involvement strategy, as well as other facets of the SEMI. The approach is intended to be bottom-u, rather than top-down.

The SEMI public involvement plan will be developed after concentrated work with the affected public. That will include interviews and round-table discussions to determine interest, level of knowledge, desire for education and input opportunities, etc. USEPA will coordinate its efforts to build upon the public involvement work of the Remedial Action Plans, the Rouge River Wet Weather Demonstration Project, and other State work.

Key Aspects of the SEMI

The SEMI is designed to provide a comprehensive and coordinated focus on environmental issues and regulatory actions in the designated geographical area. Key aspects of the initiative include:

1. Pollution Prevention

   For years, the regulatory agencies stressed end-of-pipe treatments rather than reducing the sources of releases. While this strategy has resulted in a significant reduction in pollution and corresponding environmental improvements, new strategies must be employed to realize continued improvements in the environment.

   The pollution prevention aspect of the SEMI will build on past regulatory successes, as well as current pollution prevention efforts in Southeast Michigan to effectuate further environmental improvements. Spill prevention controls and reduction of release sources will be parts of the pollution prevention efforts. A list of chemicals may be developed to assist in targeting pollution prevention efforts. At the same time, we recognize the need to incorporate pollution prevention goals into our base programs, where prevention is not already commanded by an environmental statute. An important facet of this activity will be to build a network of those engaged in pollution prevention activities in the SEMI region. Another will be to initiate and continue work toward these goals with industry.

2. Public Participation

   The SEMI area's multi-cultural population offers many perspectives on environmental issues. A SEMI public involvement strategy will be developed as a result of concentrated work with effected public. The strategy will focus on building on existing public participation activities and developing partnerships to further environmental protection, as well as a dialogue with the public about environmental justice issues, environmental risk and privatization of environmental programs. It is expected that one of the tasks initiated in the public involvement strategy will be to demographically chart exposure to contaminants and to share that information with the public.

3. Compliance and Enforcement

   The USEPA interdivisional enforcement workgroup will periodically meet with its MDNR counterpart to develop and implement a compliance and enforcement strategy. A key aspect of the strategy will be to utilize innovative methods such as multi-media inspection to promote and determine compliance in the SEMI region. Efforts will be made by the participating programs to secure the necessary data integration systems. One role of the enforcement workgroup is to ensure that pollution prevention, risk-reducing acceptable supplemental environmental projects, and critical habitat protection and enhancement are implemented in as many settlements as possible.

4. Remedial Action Plans & Sediments

   The Remedial Action Plans (RAPs) being developed under a MDNR lead for the five Area of Concerns in the SEMI region will be a priority activity. The initiative will highlight and further the work being done on these RAPs. A hot spot sediment remediation strategy will be developed and implemented.

The SEMI RAPs and Sediments Workgroup

The SEMI RAPs and Sediments Workgroup has drafted, as of August 1994, four primary goals to achieve with respect to sediment issues in Southeast Michigan. The goals are intended to fully support sediment issues, activities, and priorities being addressed by respective RAP efforts. They are:

Goal 1

Facilitate site-specific cleanups in support of RAPs based on currently available information.

Goal 2

Support a broad-scale sediment cleanup demonstration project from start to finish.

Goal 3
Support characterization of contaminated sediment problems in areas where more information is required, including initial assessments, identification of continuing and historic sources of contaminants, and determination of the lateral and vertical extent of contamination.

Goal 4
Provide technology support and transfer about sediment issues to load, state, and federal programs and organizations, as well as identify the resources potentially available to them.

These and other USEPA Region 5 Sediment Activities will continue to be developed, implemented, and completed under increased coordination with input from Stage 2 of the Detroit River RAP.

Detroit River Stage 2 Economic and Social Considerations

Stage 1 of the Remedial Action Plan (RAP) identifies impaired beneficial uses in the Detroit River Area of Concern (AOC). Each impaired beneficial use has an accompanying statement indicating a specific remediation goal. In particular, the Stage 1 RAP addresses an array of fish and wildlife issues as well as related biological concerns (e.g., benthic communities). There is also an identification of impaired beneficial uses that pertain to beach closings, restrictions on drinking water consumption, and aesthetics. While the latter concerns and fish consumption advisories are part of social and economic interests, they do not embrace the very substantial potential economic and social benefits from jobs creation, tax base retention and enhancement, infrastructure savings and recreational prospects that may occur from eliminating or mitigating contamination in the river sediments.

Based on studies undertaken for the Hamilton Harbor and Toronto AOCs, it is plausible to expect that the achievement of the Detroit River RAP goals will cost a minimum of several hundred million dollars and possibly exceed one billion dollars. To expedite acceptance of the goals and the requisite follow-through expenditure of such large sums, it is appropriate to analyze the returns that may be anticipated. While some will be satisfied with the fish, wildlife and water consumption goals as stated, others will be far more willing to support remediation expenditures if there is evidence of the economic and social advantages to be obtained as categorized above. The public is entitled to know, in advance of expenditures, what the approximate returns will be.

Economic benefits from the expenditures for cleanup per se are fairly direct and not the major consideration. Rather, it is the longer-term benefits from reinvestment and reuse of the shoreline land, and also the benefit in renewed use of water resources (e.g., fishing industry enhancements and recreation activities that provide the more substantial, relatively self-sustaining economic and social returns that might be appropriate for the justification of some remediation expenditures. Efforts to evaluate the possible economic and social returns described have resulted in estimates that indicate an approximately four-fold or greater financial benefit. (That is, for each dollar of cleanup costs, there are four dollars or more of economic benefits in terms of jobs creation, reduced expenditures for infrastructure, etc.). It may be inferred that the returns are higher, as no figure was provided for some of the benefits, (e.g., aesthetic improvements). Market potential, a critical component of any economic activity that may occur and a crucial consideration for reinvestment in previously developed waterfront properties, was not addressed in a document supporting the estimates. However, the importance of market feasibility analyses was underscored.

Riverfront housing, retail and commercial facilities, offices, recreational development, expansion of fishing industry activity and other uses that have been impaired may respond with positive, recurring and non-polluting benefits if the existing contamination problems are rectified. Examples of riverside investment with long-term positive impacts on jobs creation, tax base enhancement and other economic as well as social benefits include such well-known developments as the Renaissance Center, the City of Detroit's linked parks, Dodge Fountain and the Joe Louis Arena. These projects pre-date most of the stigma associated with polluted sites or water as well as the current liability for contaminated property. Therefore, they have had different investment desiderata than anything that might be developed along the river today. In response to legislation, combined with court interpretations, there

is great resistance to any involvement by developers or financial institutions with any site that is contaminated or suspected of being contaminated. However, there are ways to overcome this problem. Among the contributing factors that would help to restore beneficial shoreline land use and revitalization of properties to the point of making a contribution to the region (as opposed to many existing instances intensifying blight and tax base losses) would be the remediation of sediment contamination as proposed by the Stage 1 RAP. Moreover, if restrictions to land use are applied, such as certain zoning categories, it may be possible to provide an important component of protection from future contamination, based solely on reuse of shoreline land.

It is reasonable to know, in advance of major expenditures for cleanup, what the economic and social benefits may be and to evaluate those benefits using analyses which address the crucial role of market prospects and land use changes. Realistic projections of potential jobs, real estate investments, marina developments, fishing industry gains, port facility developments and recreational uses, all of which may have beneficial impacts from cleanup, are part of the research warranted as are shoreline land uses which will inhibit future contamination.

Future Role of the Detroit River Contaminated Sediments Technical Workgroup

The workgroup has decided to remain as a forum for discussing contaminated sediments issues in the Detroit River. As agencies take responsibility for remedial implementations, the workgroup with its representation of BPAC, industry, academia, and agency personnel will serve as a platform to address issues and provide comments. The workgroup will continue to update the BPAC on the progress of contaminated sediment remediation in the Detroit River and the restoration of beneficial uses associated with them.

Closing

The Contaminated Sediments Workgroup met on eleven occasions from January 1993 to November 1994. MDNR and MOEE wish to thank those individuals who attended, especially the core participants whom without their help this report would have never been compiled.

We wish to thank the facilities that hosted the workgroup. Changing the meeting locations provided a fresh perspective on the places that people live and work along the river.

A list of the topics covered at the meetings, along with the technical workgroup mailing list is located in Appendix 6.2.